AUGUST
1953

MECHANICAL ENGINEERING

ASME Fall Meeting — Rochester, N. Y., October 5-7, 1953

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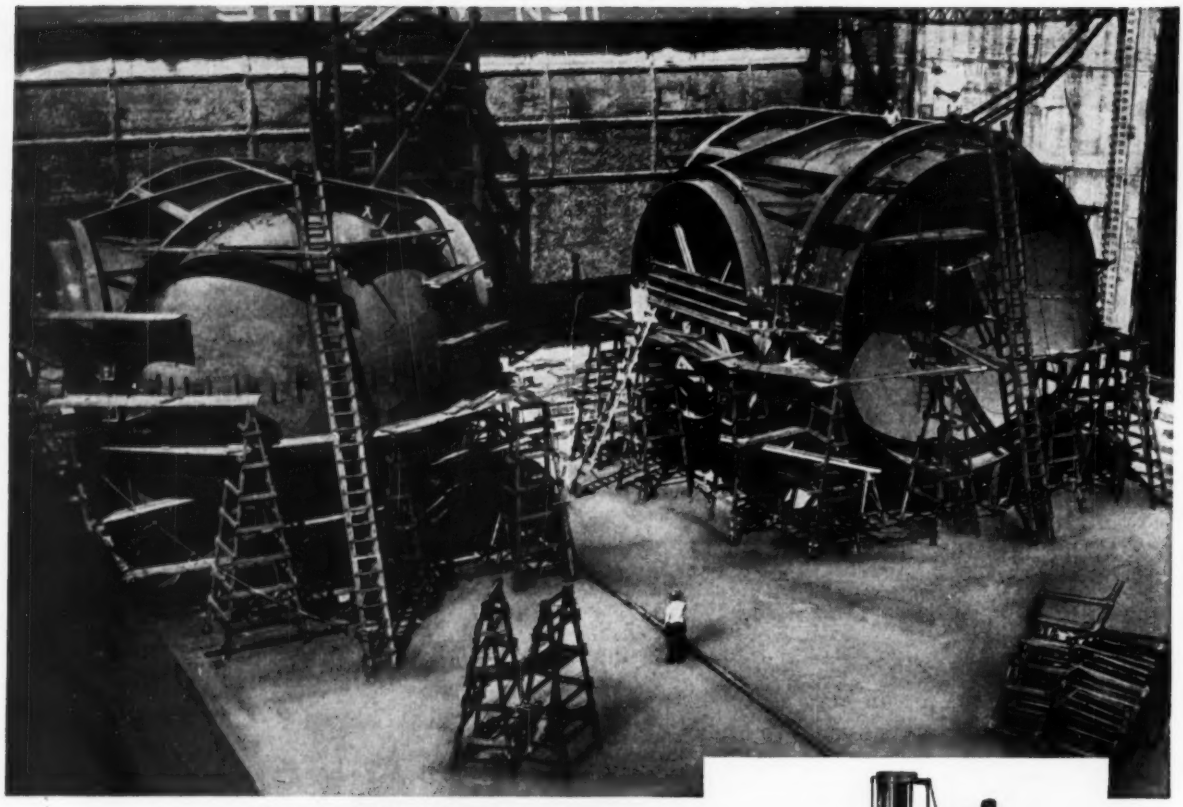
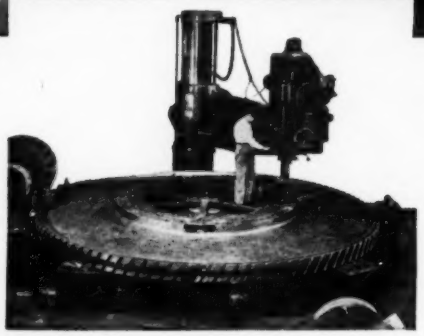


ASSEMBLING FLOW DIVERSION VALVES of an 8-foot supersonic wind tunnel for the Ames Aeronautical Laboratory of the National Advisory Committee for Aeronautics.



DRILLING A 25-TON FORGING . . . one of 11 alloy steel discs used in one of the two axial flow compressors which Newport News is constructing for the NACA's Ames laboratory.

Man-made Hurricanes

PUSH A BUTTON . . . That's all it will take to accelerate wind up to several times the speed of sound in a new supersonic wind tunnel at the Ames laboratory of the National Advisory Committee for Aeronautics, in Moffett Field, California.

The tunnel is designed to develop new aerodynamic information. Its heart is the "windmaker" . . . two axial-flow compressors which look like a giant tube 50 feet long and 24 feet in diameter, studded with small blades.

Because of the size of this unit, it is significant that the task of building these mammoth compressors was assigned to Newport News.

Newport News has also constructed two diversion valves, similar to huge plug valves, for diverting the air flow from one channel of the tunnel to another, as desired.

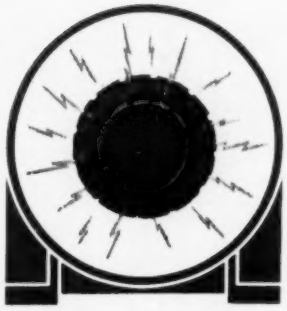
Large engineering and technical staffs, operating a plant with acres of brass, iron and steel foundries, five huge machine shops and other extensive fabricating facilities, make Newport News an ideal source for large equipment . . . *standard or special in design.*

Products ranging from components of rayon spinning machines to giant 165,000 horsepower hydraulic turbines operating at Grand Coulee, reflect Newport News' high integration of skill and production facilities.

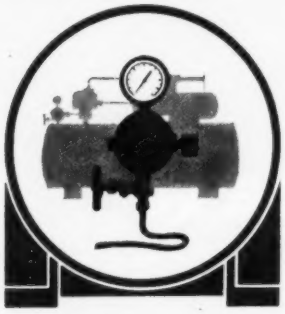
Consult us on equipment for your present or future projects. Write today for your copy of *"Facilities and Products."*

NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY
Newport News, Virginia

Refrigeration & Air Conditioning

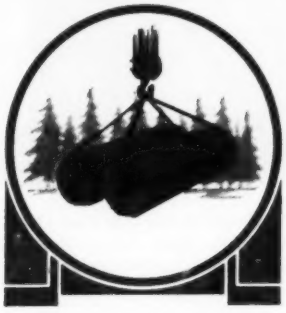


Electrical Generation



Air Compressing

D. C. Generation



Paper Processing

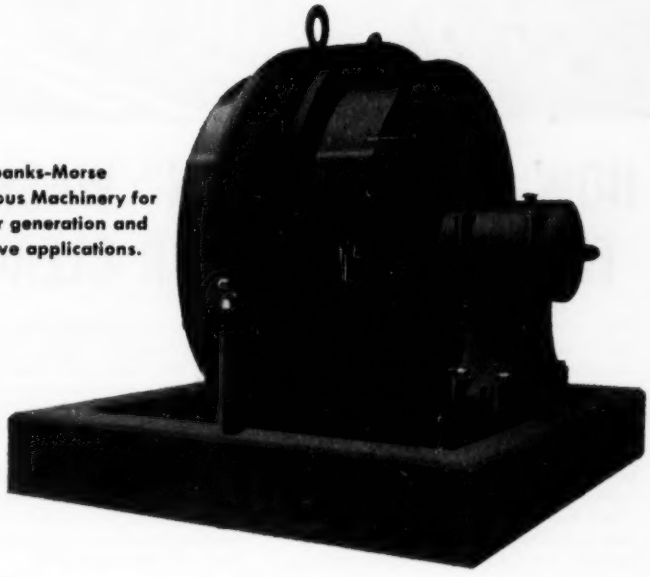
Electric Motors

for every industry

When you need electric motors . . . in any rating, or frame type . . . one or a thousand . . . *always* look for the Fairbanks-Morse Seal. For over 120 years it has stood for the finest in manufacturing integrity to *all* industry.

Fairbanks, Morse & Co., Chicago 5, Illinois.

Fairbanks-Morse Synchronous Machinery for all power generation and large drive applications.



FAIRBANKS-MORSE

a name worth remembering when you want the best

ELECTRIC MOTORS AND GENERATORS • DIESEL LOCOMOTIVES AND ENGINES • RAIL CARS • PUMPS • SCALES • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS

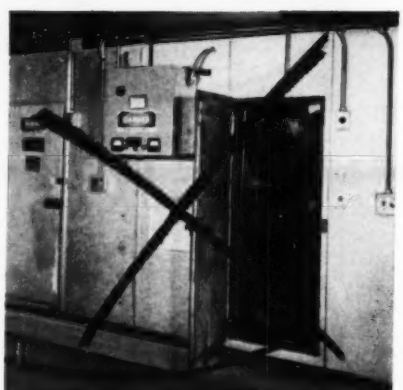
NOW—"PUSH-BUTTON" WASHING FOR ELECTRONIC AIR CLEANER

Now, a new, low-cost, automatic PRECIPITRON® washer cuts maintenance costs and eliminates unpleasant inside-the-duct washing of cells.

This unique device features moving nozzles, making PRECIPITRON the easiest electronic air cleaner to service. After thoroughly cleaning the plates, the washer re-applies adhesive. Entire operation is under "push-button" control. Laboratory and field tests have proved that moving-nozzle washing is a "must" for proper cleaning.

Type PX PRECIPITRON, the electronic air cleaner, traps microscopic airborne particles of dirt, dust, grime and pollen which would pass through conventional filters. It fits into any heating, ventilating or air conditioning ductwork.

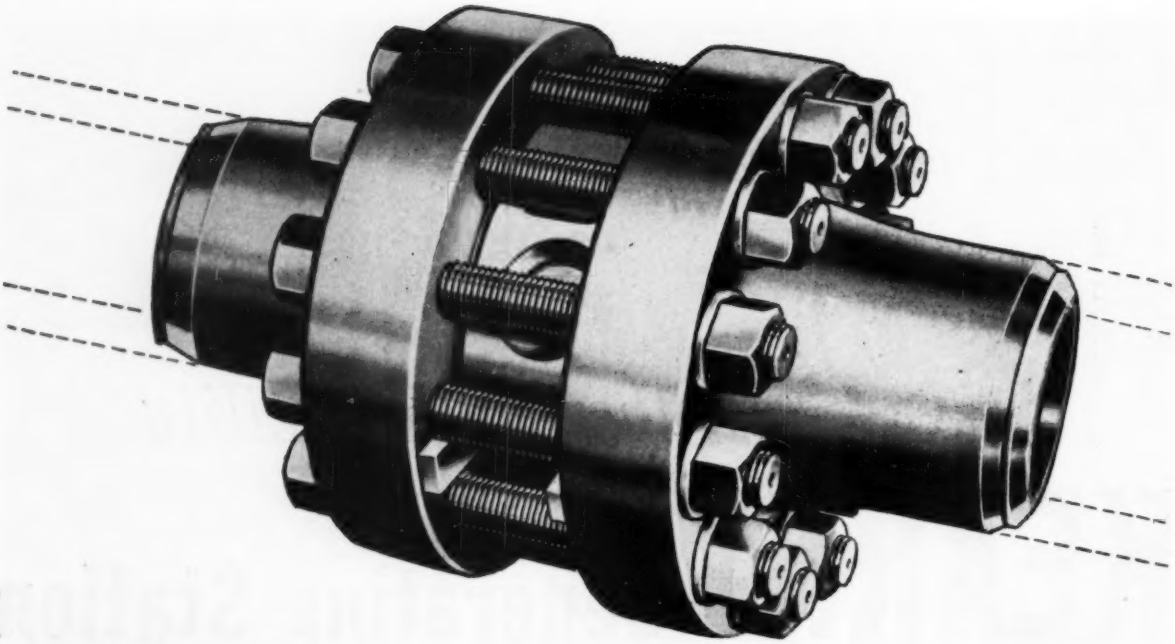
Learn how PRECIPITRON will keep the air in your building dirt-free at negligible cost. Call your local Westinghouse-Sturtevant office, or write: Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.



Maintenance men no longer need to enter enclosure to clean PRECIPITRON. New "push-button" feature does away with hot, wet tasks.

WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE ... IF IT'S Westinghouse J-80231

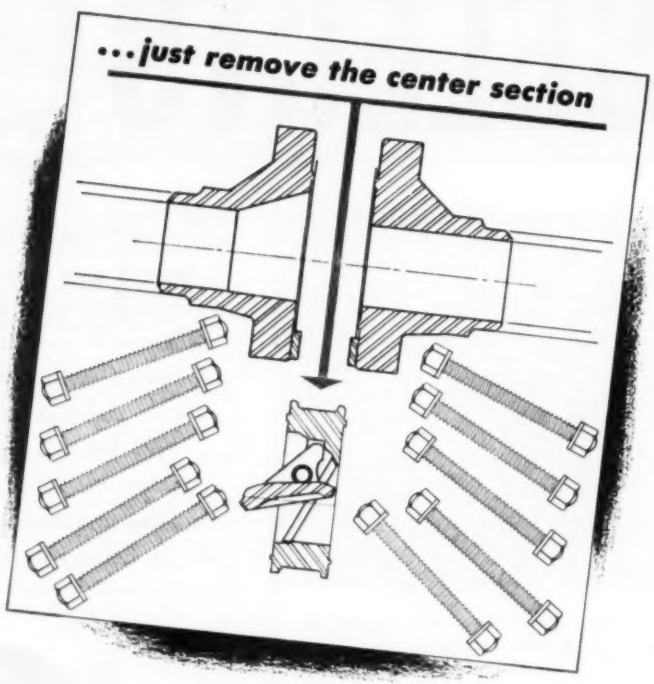


NO NEED to cut this valve out of a Welded Line

...it's a CHAPMAN 3-PIECE TILTING DISC CHECK VALVE

Remove studs between inlet and outlet ends. Then the whole center section can be slipped out *as a unit* . . . and quickly and easily replaced. Figure the savings for yourself!

Here, Chapman design gives you the smooth operation and quiet closing of the 2-piece Tilting Disc Check Valve . . . with the unique advantage of practically immediate interchangeability of "the works." And *only* Chapman makes this complete line of Tilting Disc Check Valves. Send for your Chapman "Check Book" — *now!*



The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASSACHUSETTS

New simplicity in process cooling!

Yours now from a single packaged unit—the new TRANE Cold-Generator

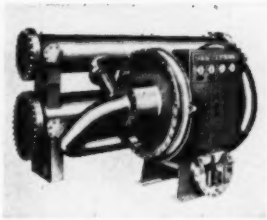
New TRANE Cold-Generator . . .

factory assembled, tested . . . ready to install!

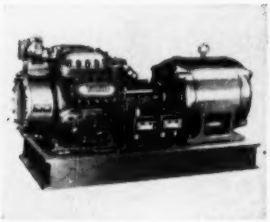
Now you can have chilled water *from a single package* at a temperature exactly suited to electroplating, metal quenching, die cooling, rubber mixing . . . almost any industrial process.

The new TRANE Cold-Generator combines the TRANE Reciprocating Compressor with matched components into a single compact unit . . . factory engineered, factory assembled, factory tested. Factory guaranteed! *So simple to install that your regular crew can do the job quickly, easily. No refrigeration work required—it's done for you at the factory!*

Five sizes for loads from 10 tons up. Only simple electrical and plumbing connections needed.



For larger jobs, choose CenTra-Vac—this hermetic centrifugal refrigeration unit provides 45 to 200 tons of refrigeration. Self-contained, completely automatic. Only one major moving part.



TRANE Reciprocating Compressor assures long life, quiet operation, simplified installation and maintenance on any process or comfort air conditioning system. Capacities from 3 to 50 tons.

New TRANE Cold-Generator

brings you process cooling in a package!

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 87 U.S. and 14 Canadian Offices

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

the Motor Speed Control

that Cuts Lathe Time and Improves Quality

Facing off a 4½" diameter dial where very smooth finish is required. The Type 1702-A Variac Motor Speed Control enables the operator to slow lathe speed as larger diameter is worked. Maintaining cutting-feet-per-second constant avoids chatter.

Variac MOTOR SPEED CONTROLS are COMPLETE units for operating DC Motors from AC Lines, and feature:

- ★ Low Speed
- ★ Selenium Rectifiers for Ruggedness
- ★ Good Regulation
- ★ No Pulsating At Low Speeds
- ★ Easy Installation and Maintenance
- ★ Wide Speed Range
- ★ High Starting Torque
- ★ Rapid Starting and Stopping
- ★ Dynamic Braking

If you need a speed control which will increase the everyday versatility of your lathe and enable you to meet the most stringent production requirements . . . the Variac Motor Speed Control is the answer. This smoothly operating control makes lathe work much more efficient. In production, it enables quality work to be turned out rapidly and reliably. Variac controls are available in three sizes for 1/15th to ¾ hp motors.

LATHE OPERATORS who use these Controls REPORT THESE TIME-SAVING FEATURES:

★ *Variac Speed Controls eliminate need for changing step pulleys or gears — twist of a knob gives any speed from 5 or 10 rpm to rated*

★ *Instant Starting — no waiting for gears to mesh or engage as in mechanical controls — rapid reversing where needed*

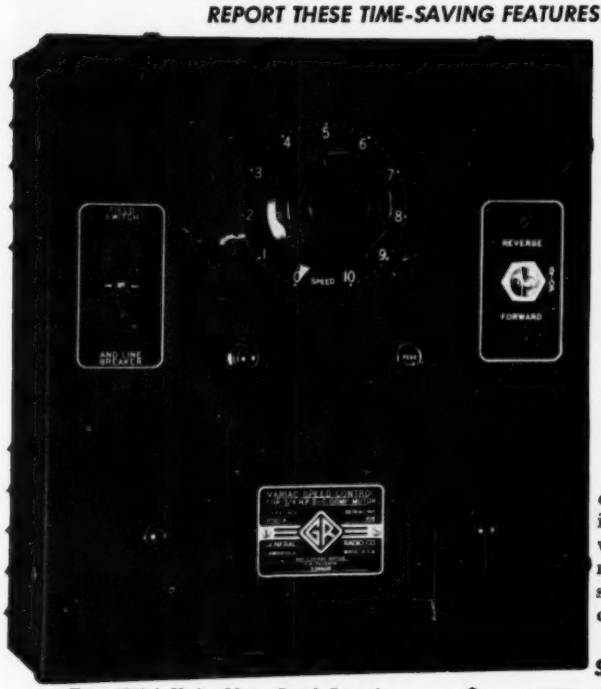
★ *Instantaneous Braking Saves Production Time — permits sudden stops, eliminating tool overruns when under power feed or when cutting screw threads*

★ *Infinite Selection of Speeds — machine is slowed or speeded for optimum operation by flick of the wrist — in turning or facing operations, speed can be varied continuously as diameter of stock changes*

★ *Power at Few RPM — considerably more power at slow speeds makes this control invaluable in reaming and many other applications*

★ *Less Wear and Tear On Tools — speed can be set to suit material being worked or tool being used*

★ *Tapping in Slow Motion — with Variac Speed Control, lathe can be run at few rpm while tap is slowly run into drilled piece — eliminates necessity for measuring depth of drill hole on tap and carefully watching distance to which tap is advanced — motor stalling when tap is all the way in prevents tap breaking or spoiling of threads*



Type 1702-A Variac Motor Speed Control — plugs into regular 115v a-c power lines — provides continuous control of ½ and ¾ hp d-c motors — unit is completely self-contained — price $230, less motor

Variac Motor Speed Controls are amazingly efficient devices for the control of everyday machine operations including precision drilling — grinding — toroidal wire winding and screw cutting. They are time tested, highly recommended tools widely used in machine shops and large-scale factory production departments throughout the country.

SEND IN COUPON FOR MORE INFORMATION

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275 Massachusetts Avenue, Cambridge 39, Massachusetts, U. S. A.

90 West St NEW YORK 6 920 S. Michigan Ave CHICAGO 5 1000 N. Seward St LOS ANGELES 38

General Radio Company, 275 Massachusetts Ave., Cambridge 39, Mass.

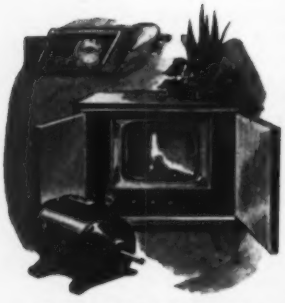
Please send me a copy of the VARIAC Motor Speed Control Bulletin:

Name_____
(579)

Company Name_____

Street_____

City_____ Zone_____ State_____

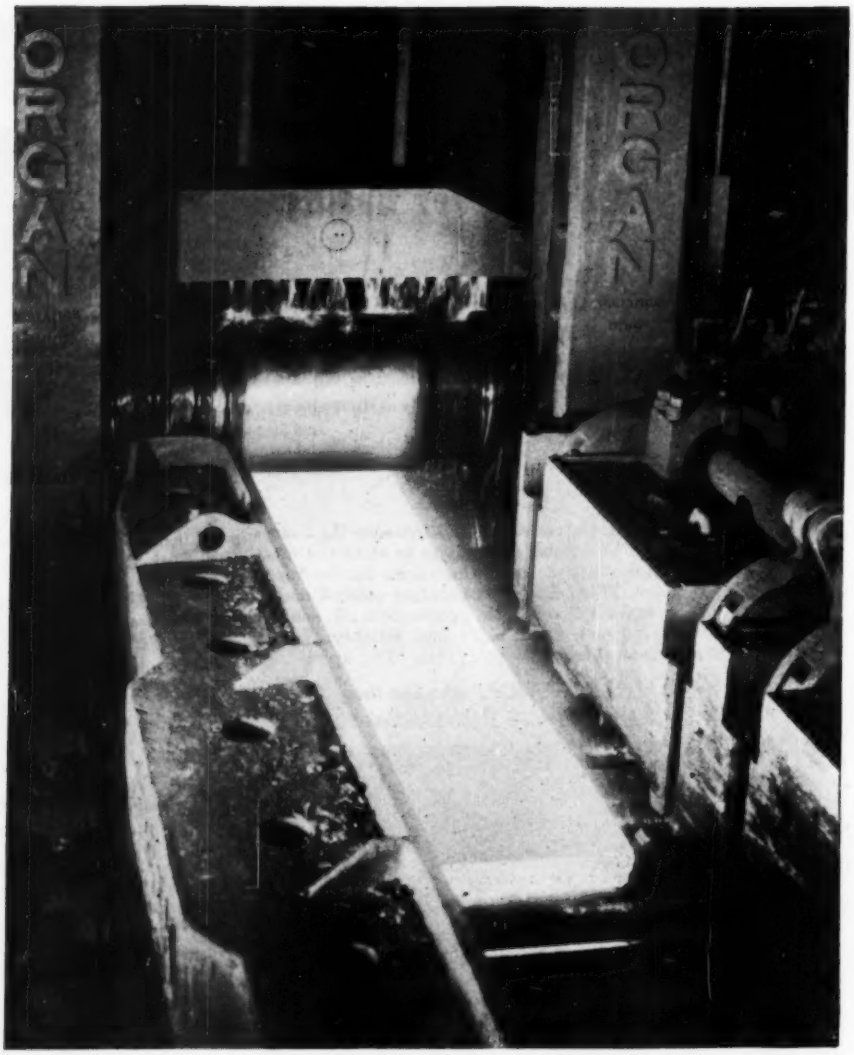


SPECIAL ELECTRICAL ALLOYS

CORROSION and HEAT-RESISTANT STEELS

Warehouse stocks of Allegheny Stainless carried by all Ryerson plants

TOOL and DIE STEELS



Coming at you —

One of the Royal Family of Steel

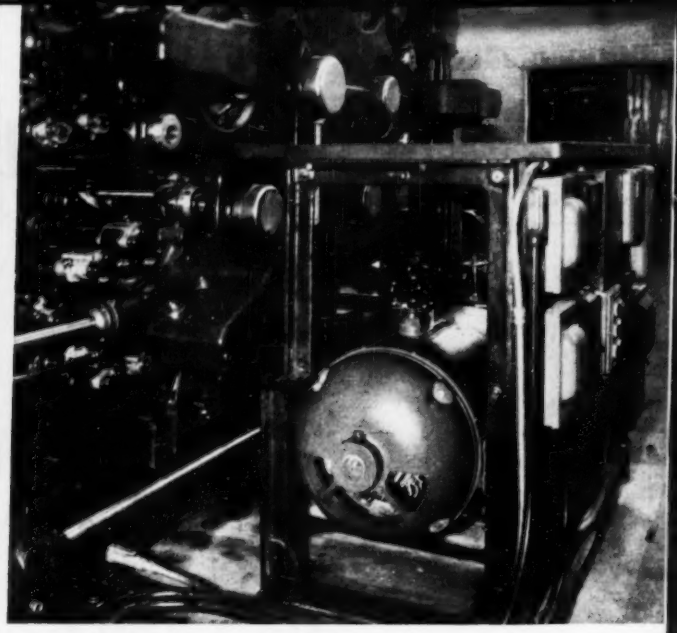
Our niche in the economic health of this nation in peace, and its defense in war, is to develop and produce the high-alloy steels and other special alloys which will do what ordinary metals cannot even approach in resisting corrosion, heat and wear, and in performing vital electrical and electronic chores. Whenever you have problems in these fields, the place to come is **Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.**

PIONEER in Specialloy Steels

Allegheny Ludlum

AL
TIME-TESTED STAINLESS STEEL

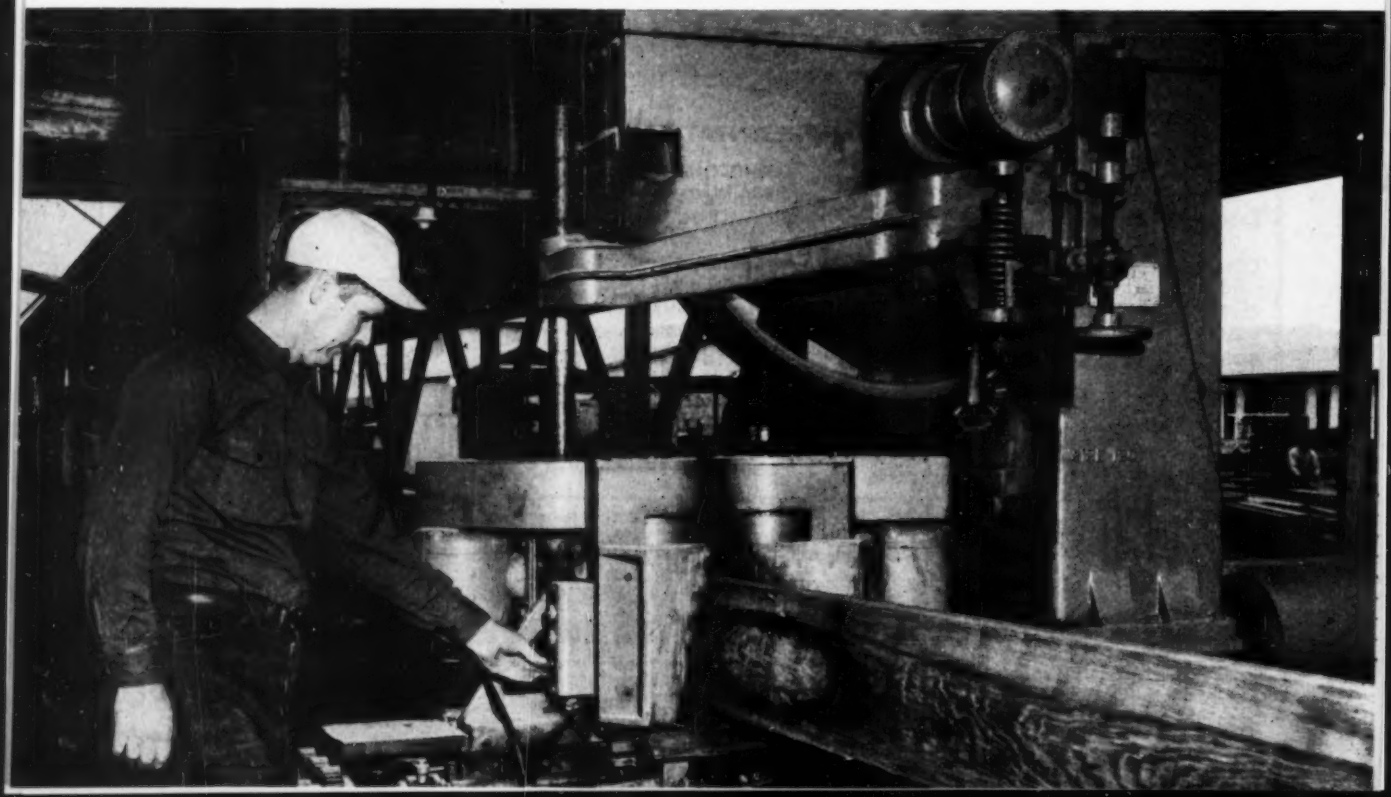
W&D 4092 B



G-E ACA MOTOR as applied on a monotype casting machine in the plant of the Los Angeles Examiner (left) and as the main drive on a five color press in the plant of the Kansas Color Press, Lawrence, Kansas. The G-E ACA motor is your simplest and most economical electrical adjustable-speed drive. You get stepless speed adjustment directly from AC power over a 3 to 1, 6 to 1, and 20 to 1 range. No external conversion equipment is necessary. For additional information, check the coupon for Bulletin GEA-4883.

How a G-E Adjustable-speed Drive

G-E THY-MO-TROL* DRIVE at the San Jose Lumber Sales and Milling Company, San Jose, California, enables the operator to vary the speed of the resaw feed roll from 8 ft. to 250 ft. per minute. G-E Thy-mo-trol Drive can be made to hold speed regulation as close as ± ½%. It is available between 1/40 and 75 horsepower and offers smooth, stepless speed adjustment ranging up to 100 to 1. G-E Thy-mo-trol is easy to install, maintain, and operate. For complete information, check Bulletin GEA-5337 in the coupon at right.



TWO G-E SPEED VARIATORS, one of which drives the cutter-head and the other the bar-feed on this installation at the Alleghany-Ludlum Steel Co., Watervliet, N. Y. G-E Speed Variators are available in ratings from 1 to 200 hp, with excellent speed regulation and in speed ranges up to 40 to 1. With the addition of an amplidyne or electronic regulator, the Speed Variator will give you even closer speed regulation. The packaged power unit is easy to maintain, easy to move to new locations. Ask for Bul. GEA-5335 and 36.

can increase your production!

G-E ADJUSTABLE-SPEED DRIVES mean accurate, stepless motor speed control . . . the chance to improve the versatility of your present machinery . . . increase your production. With a G-E Adjustable-speed Drive you can reduce waste . . . improve product quality.

G-E ADJUSTABLE-SPEED DRIVE WILL ENABLE YOU to produce a greater variety of goods . . . for with the flexibility of adjustable motor speeds you can greatly diversify your product output. Fundamental speed adjustment is available from the G-E ACA motor which is controlled by a simple twist of the dial . . . precise speed control can be obtained with the G-E Thymo-trol drive or Speed Variator. Whatever your need, there is a General Electric Adjustable-speed Drive for you . . . packaged drives are available from 1/40 to 200 hp . . . speed ranges from 3 to 1 up to 100 to 1.

TO GET COMPLETE INFORMATION consult your nearest General Electric Apparatus Sales Office. Your G-E Sales Representative will be glad to recommend the most economical drive best suited for your operation. For printed information on the complete line of G-E Adjustable-speed Drives, use the coupon.

**Reg. Trademark of the General Electric Company.*

You can put your confidence in—

GENERAL ELECTRIC

LET G.E. HELP YOU PICK THE RIGHT DRIVE

Because only General Electric makes all major types of electric adjustable-speed drives, it is best qualified to help you select the right drive. Send for these informative bulletins.

☐ **A. This 26-page manual describes all four types of drives and where to apply them. Bulletin GEA-5334.**

☐ **B. Lower cost, simplest a-c drive. Bulletin GEA-4883.**

☐ **C. More flexibility, moderate cost. Bulletin GEA-5335.**

☐ **D. Top performance, 1/40—75 hp. Bulletin GEA-5337.**

☐ **E. Top performance, 1–200 hp. Bulletin GEA-5336.**

General Electric Company
Section M 646-23
Schenectady 5, N. Y.

Please send me the bulletins checked
☐ **for reference only**
☐ **for planning an immediate project**

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COMPANY.....

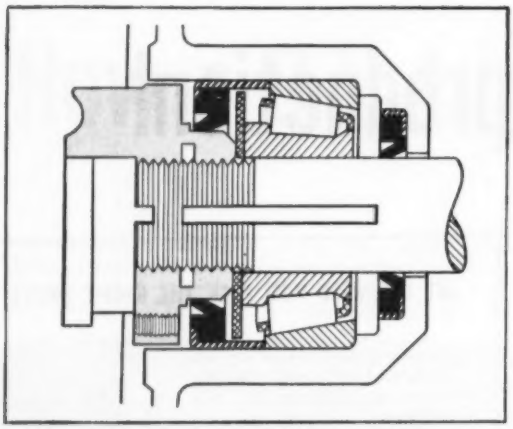
ADDRESS.....

CITY..... **STATE**.....

New Continental Idler operates 1, 2, 3, or more years without relubrication . . .

WITH THE HELP OF KLOZURE*

Oil Seals



The new Continental UST idler uses two KLOZURE Oil Seals—one outboard and one inboard—to insure maximum bearing protection.

This UST factory-sealed belt conveyor idler, developed by The Continental Gin Company, was designed primarily to cut maintenance costs and insure a longer life for both the belt and idler assembly. Continental engineers wanted an idler that would operate satisfactorily without re-lubrication for one, two, three, or more years. That's why they chose a pre-lubricated sealed unit incorporating tapered roller bearings and dependable KLOZURE Oil Seals.

Garlock KLOZURES protect the bearings on Continental idlers by keeping the lubricant *in*, the dirt and moisture *out*. In addition, the KLOZURE assembly prolongs belt life by preventing the leakage of grease on to the belt.

For positive bearing protection specify KLOZURE Oil Seals for your machinery. KLOZURES are made in many models and in a complete range of sizes.

Write for Klozure Catalog No. 10.

Model 71-A Springless KLOZURE, the inboard seal

Model 71-A-7 Springless KLOZURE, the outboard seal

*REGISTERED TRADEMARK

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
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GARLOCK

PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS,
RUBBER EXPANSION JOINTS

Engineered FOR ACCURATE FIT-UP

THIS TUBE-TURN Welding Return is engineered for shape, size and wall thickness to simplify piping installation. It is forged by the only process that produces a wall as uniform in thickness and true in circularity as the original seamless pipe. This assures accurate fit-up and perfect alignment . . . whether it is used as a full 180° return or cut to any odd angle.

When you specify TUBE-TURN Welding Fittings and Flanges, you are *sure* of getting the ultimate in piping simplicity, safety and permanently leakproof construction. Your nearby TUBE TURNS' Distributor is at your service!

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles • Denver • Atlanta

Subsidiaries: TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO • PENNSYLVANIA FORGE CORPORATION, PHILADELPHIA, PA.

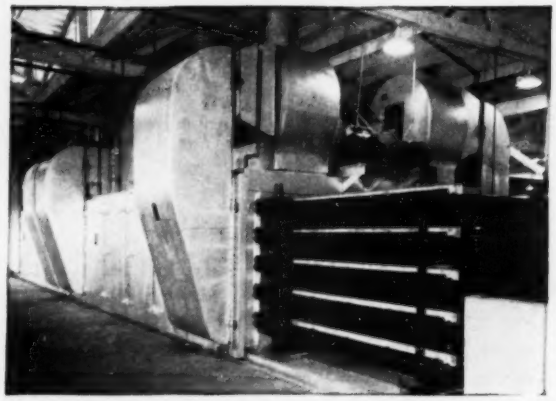
HERE'S SERVICE

TUBE TURNS' *Engineering Service*
HELPS IMPROVE A DRYER DESIGN

C. B. McLaughlin, manager of TUBE TURNS' Engineering Service Division has been working with designers and piping men in the field for years. He and his men are at your service.

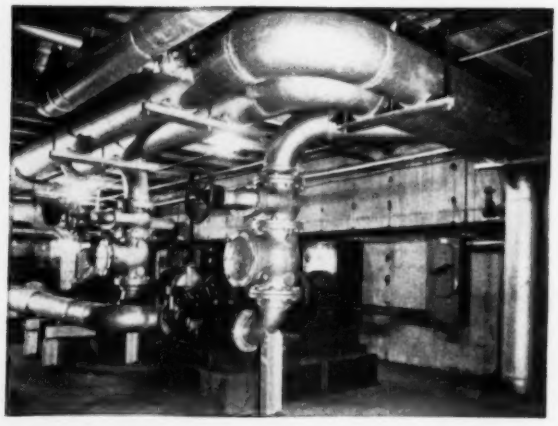
WHERE PIPING is a component of plant equipment, more and more designers are using TUBE-TURN Welding Fittings for directional changes. Results: greater design flexibility, reduced maintenance, less weight and space, improved operation. An example is the veneer dryer shown . . . a product of Coe Manufacturing Company, Painesville, Ohio. Progressive engineers of Coe, with the help of TUBE TURNS' Engineering Service Division, converted the heater from screwed connections to welded construction. Each of its banks of 1-inch pipes is joined by 180° TUBE-TURN Welding Returns. The coils carry steam at 200 psi pressure and 388°F. Joints are now permanently leakproof.

TUBE TURNS' Engineering Service is available to help in *your* piping problems.



Coe Veneer Dryer. Welded coils with TUBE-TURN Welding Returns are compact and permanently tight.

YOUR DISTRIBUTOR of TUBE-TURN Welding Fittings and Flanges can serve you promptly. He is backed up by the entire TUBE TURNS' organization.



COMPACT. Welded piping nests together . . . saves space. These condenser lines are for air conditioning system at Lazarus Department Store, Columbus, Ohio.

Want Materials Data?

Tube Turns, Inc. has prepared a booklet listing properties and specifications of steps and fitting materials—carbon steels and wrought irons, stainless steels, nickel and nickel alloys, etc. Get it free—just mail this coupon.

TUBE TURNS, INC., Dept. F-8
224 East Broadway • Louisville 1, Kentucky

Your name .....

Position .....

Company .....

Nature of business .....

Address .....

City ..... *State* .....

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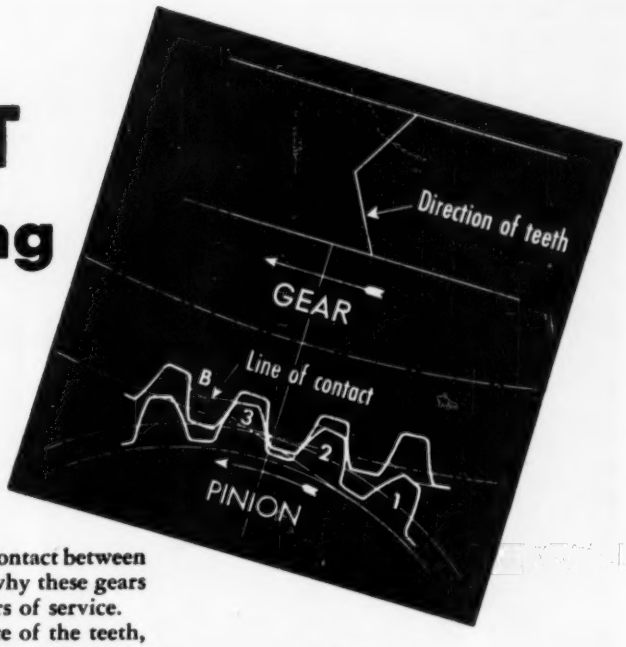
"tt" and "TUBE-TURN" Reg. U. S. Pat. Off.

TUBE TURNS, INC.
LOUISVILLE 1, KENTUCKY

BLUEPRINT for longer-lasting GEARS



This diagram, which illustrates the nature of the contact between a pair of Farrel-Sykes herringbone gears, shows why these gears continue to operate smoothly after so many years of service.

The lines of contact are oblique across the face of the teeth, and the pressure is evenly distributed over each tooth, from tip to working depth line. This means that there is no tendency for the contour of the teeth to wear unevenly.

The quiet, vibration-free performance of these gears results from extreme accuracy of tooth spacing, contour and helix angle, and other qualities inherent in the Farrel-Sykes method of gear generation. Precision manufacture and the use of highest grade materials also contribute to long gear life.

Farrel engineers are available to assist in working out unusual problems involving gears or speed reducers. Write for further information.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.

Sales Offices: Ansonia, Buffalo, New York, Boston, Akron, Detroit, Chicago, Memphis, Minneapolis, Portland (Oregon), Los Angeles, Salt Lake City, Tulsa, Houston, New Orleans

HERRINGBONE GEARS

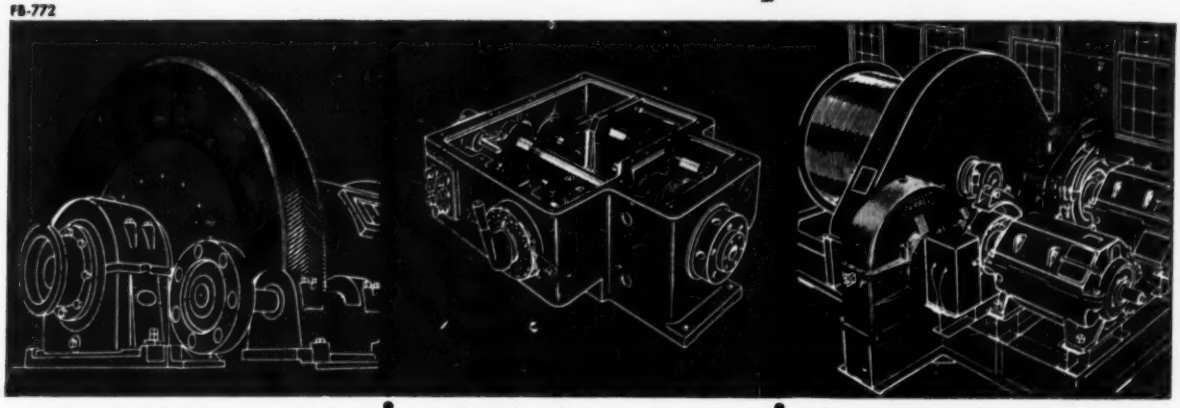
Farrel-Sykes herringbone gears are made in any size from ¼" to 20'0" diameter, for any power capacity and speed.

SPEED REDUCERS

Farrel speed reducing units are available in a wide range of ratios and capacities. Designs include single, double and multiple reduction units, right angle drives and drives to meet special requirements.

Farrel-Birmingham ®

FB-772



Ball mill equipped with Farrel-Sykes gears. The drive gear is 140" diameter, 18" face.

Farrel-Sykes herringbone gears used in the headstock of a lathe.

Skip hoist driven by two motors through Farrel speed reducers.

have coil springs made of *precision rolled rounds...*

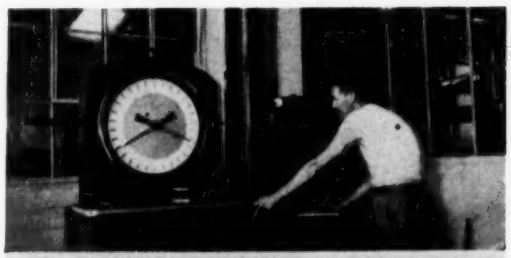
...twice as accurate as ordinary hot-rolled bars
...practically eliminate centerless grinding...cost less to make

IN the early days of the development of coil springs for front suspensions of automobiles, the only steel that was available was an ordinary hot-rolled bar from which as much as .035" of metal per side had to be removed by grinding to insure freedom from harmful seams, pits, and decarburization. This cost money, was wasteful and time consuming.

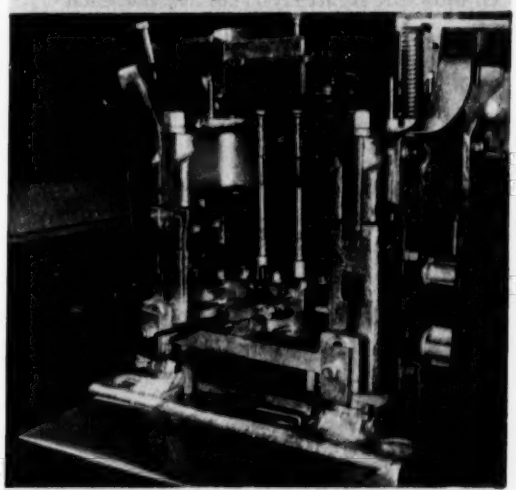
This seemed to be an expensive approach to a simple problem, so United States Steel equipped one of its mills to produce hot-rolled bars so free from harmful defects that most of the grinding expense could be eliminated. A method was devised for rolling a bar to half the standard tolerances, with half or less the amount of decarburization, which made it attractive to use the material "as furnished" or with a small amount of centerless grinding. We call this bar a Precision Rolled Coil Spring Round. It has performed excellently when used "as furnished" or with a small amount of grinding.

This exclusive development has paid off in two ways. It paid us because the CARILLOY Precision Rolled Coil Spring Round is now used in over half of the coil springs in new automobiles. But, most of all, it has paid off for the automobile manufacturer in that his costs are reduced with performance of the highest order. Today we are still hard at work developing new and better alloy steels for other new uses in automobiles; for example, in automatic transmissions, power steering units and other new and vital automobile parts.

Our experienced engineers and metallurgists will be glad to consult with *you* on any steel or fabrication problem. Just write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.



COIL SPRINGS made of CARILLOY Precision Spring Rounds are uniform as proven in severe laboratory tests, as well as in actual service on America's best automobiles. They perform so well that half of all automobile coil springs are now made of CARILLOY steel.



AT THE GARY WORKS of United States Steel, this precision mill rolls CARILLOY Coil Spring Rounds with extreme accuracy. Tolerances are half of standard; .004" on the diameter, instead of the usual .008", and only .006" out of round, compared to .012" on ordinary rolled bars.

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
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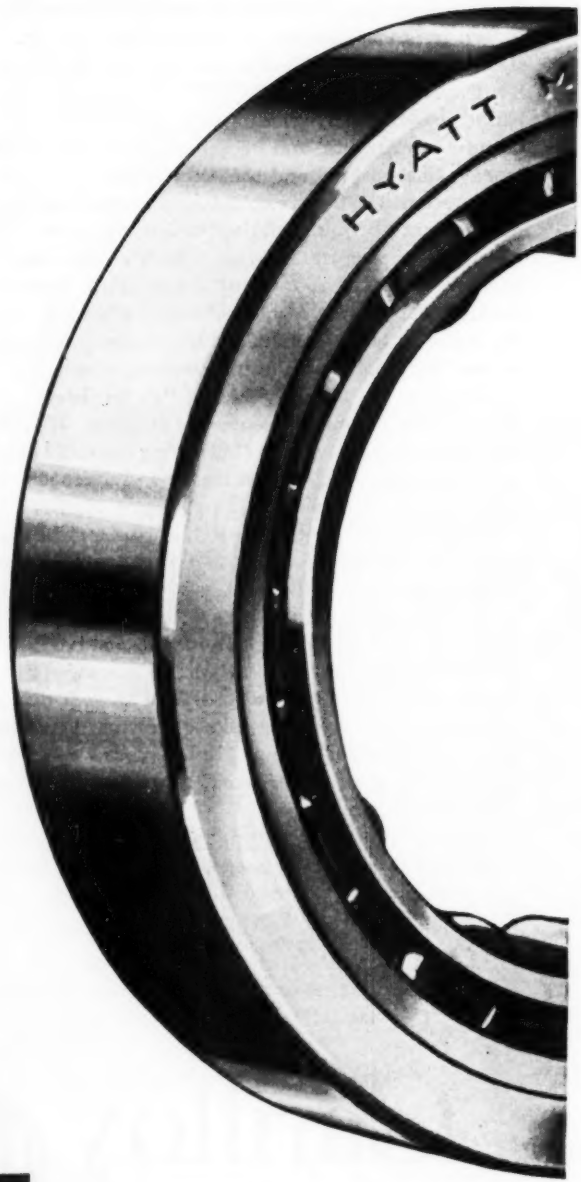
Carilloy USS Steels

ELECTRIC FURNACE OR OPEN HEARTH — COMPLETE PRODUCTION FACILITIES IN CHICAGO OR PITTSBURGH

3-1408

UNITED STATES STEEL

10 designs for heavy duty



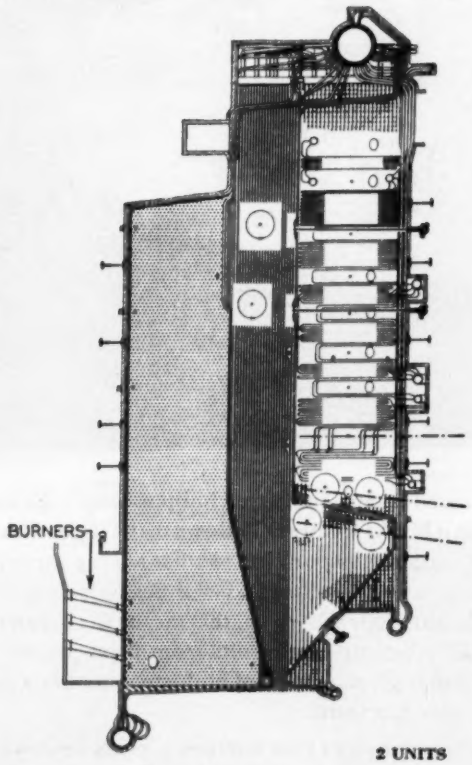
Ten different Hyatt Hy-Load designs, each in a variety of widths and sizes, assure you the right bearing for every radial need.
Four Hy-Load designs have separable inner races, two have separable outer races and four are non-separable. All are high-capacity, cylindrical roller bearings for the heaviest radial loads and light or intermittent thrust loads.
All separable parts are freely interchangeable within the same size. This permits non-selective fitting after pre-assembling the two bearing parts in separable machine elements.
Whatever your radial load problem, Hyatt Hy-Loads or some of the other types of Hyatt bearings can provide the answer. Because Hyatt offers industry's most complete line of straight radial roller bearings. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

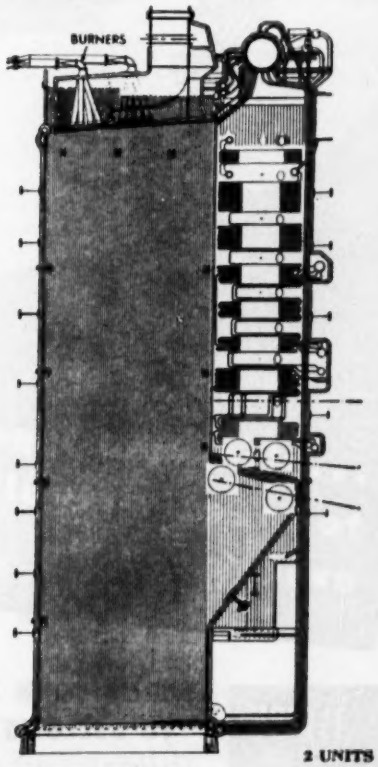
DIAMOND Boiler Cleaning Systems again selected by American Gas & Electric

for

MUSKINGUM RIVER PLANT
The Ohio Power Company



KANAWHA RIVER PLANT
Appalachian Electric Power Company



Similar, yet different, these units are built in the tradition of American Gas & Electric philosophy: "for tomorrow." Incorporating high pressure . . . high temperature . . . reheat . . . pressure firing . . . flue gas recirculation, they will provide economical power to serve the growing capacity needs in two different areas.

Both plants will have Diamond retractable type blowers (throughout) to assure safe, economical and reliable operation. These units are constructed along principles successfully established at Twin Branch, Tanners Creek and Philip Sporn Plants which are all Diamond equipped *throughout.*

50th ANNIVERSARY 1903-1953

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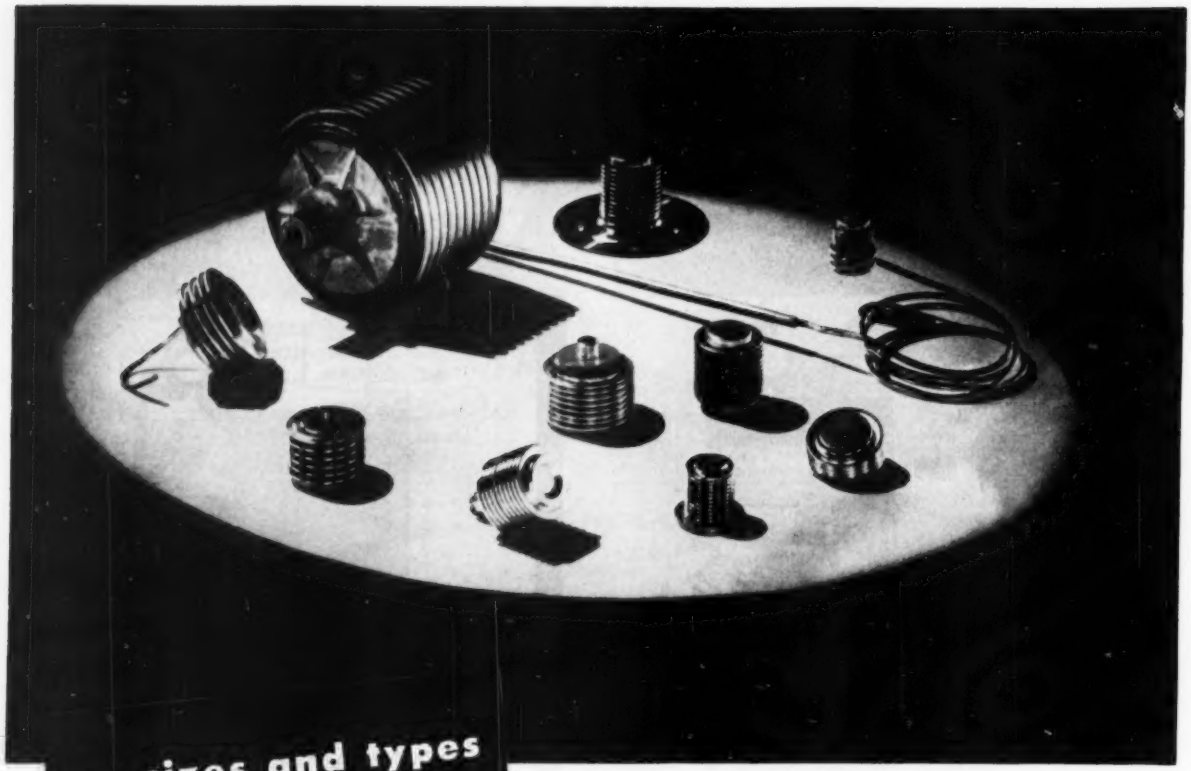
These are Flexon BRASS Bellows



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The Flexon Bellows Design Guide offers useful application data and basic specifications on Flexon Brass and stainless steel bellows. Write for your copy, today or see Flexon Bellows specifications in Sweet's File for Product Designers.

Advanced manufacturing techniques employed in making FLEXON Brass Bellows make it possible for Flexonics Corporation to offer a wide variety of bellows and bellows assemblies as standard production items. For you, this means the greater overall economy that results from mass production and high standards of uniform adherence to your specifications.

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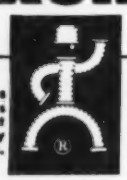
Flexon identifies products of Flexonics Corporation that have served industry for over 50 years.

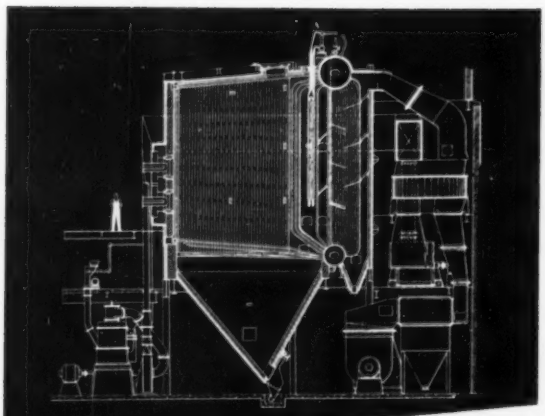


Flexible metal hose

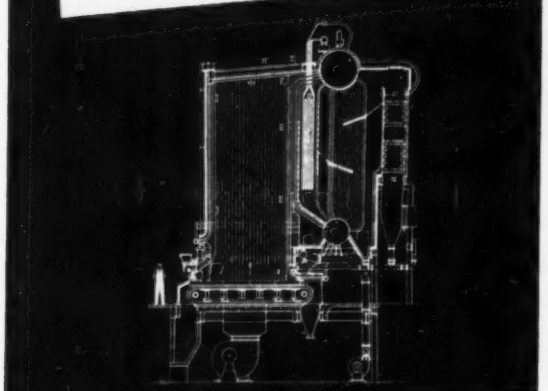
Expansion joints

Aircraft components

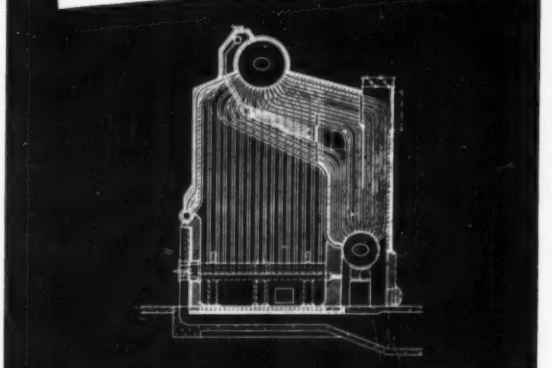
Metallic bellows and bellows assemblies



VU installation in a **TEXTILE PLANT.** This unit is fired with pulverized coal. Capacity—150,000 lb of steam per hour; operating pressure—600 psi; steam temperature—700 F.



VU installation in a **TOBACCO PLANT.** This unit is fired by a C-E Spreader Stoker (continuous discharge type). Capacity—80,000 lb of steam per hr; operating pressure —425 psi; steam temperature—650 F.



VU installation in an **AUTOMOTIVE PLANT.** This unit is fired with oil. Capacity—40,000 lb of steam per hour; operating pressure—150 psi.

How different are your steam requirements?

Every engineer knows that steam requirements vary from industry to industry . . . from plant to plant. It is virtually certain, therefore, that your particular conditions of fuel, load, capacity, pressure and temperature are not exactly the same as those of any other plant.

Yet the C-E Vertical-Unit Boiler can deliver top performance in your plant . . . just as it has done in hundreds of others . . . representing a wide variety of steam conditions.

This is because the basic design of the VU allows exceptional latitude in the selection of the *right* boiler to fit your particular requirements. It is available in capacities from 10,000 to 350,000 lb of steam per hr, with pressures from 160 to 1000 psi and temperatures up to 900 F, or more. It is adaptable to limited space conditions and to the use of any fuel or method of firing. The VU may be operated over a wide range of output, and, depending on fuels and the use of heat recovery equipment, efficiencies range up to 88%.

How well is the Vertical-Unit Boiler meeting the steam requirements of different industries? The answer is to be found in an impressive record of orders and repeat orders covering virtually every field. If you would like first hand information on the story of the VU Unit in *your* industry we would be glad to send it to you.

* * *

The point is that the story is the same . . . in industry after industry . . . *the popularity of the C-E Vertical Unit Boiler is widespread and steadily increasing.* Why not investigate how the variables of your requirements can be matched with the VU Unit for top performance?

B-540A

C-E

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ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

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factory assembled and tested

This Iron Fireman firing unit is much more than just a burner. It's a complete combustion system, including burner, automatic controls, fuel system and forced draft air supply integrated into a single balanced package unit. It is readily applied to Scotch marine or other types of high or low pressure boilers by bolting to the boiler front.

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See your Iron Fireman dealer or write for further information to Iron Fireman Manufacturing Company, 3062 West 106th Street, Cleveland 11, Ohio. In Canada, write 80 Ward St., Toronto, Ontario.

1. Assembled and tested at factory instead of on the job.
2. Applicable to practically all types of boilers.
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MIDWEST PIPING
is shop-fabricated piping that
saves manpower

The installation of Midwest Piping requires the minimum number of man hours because the difficult operations have been performed in the fabricating plants so that field erection time is reduced to a minimum. This makes possible earlier operation of the plant. Another reason for this time saving is that every subassembly is carefully checked before shipment to make sure it is dimensionally correct and accurate in alignment. The difficulty often encountered in securing skilled mechanics for field work makes this advantage of Midwest Shop-Fabricated Piping now more important than ever before.

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To Complete Piping Systems For Power Plant 

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WORLD'S FASTEST In a trial run, "Slo-Mo-Shun IV" streaks over Lake Washington, Seattle, at better than 180 miles an hour.

What keeps her from flying to pieces?

Death crowds right into the cockpit beside you when you drive a boat like that.

Strange things happen. Every little wave jars the hull like a rutted road. Your foot burns at the touch of the jiggling accelerator. Your eyeballs jounce around in their sockets like glazed marbles as you keep watch for a sight you never hope to see:

Screw heads popping off like bullets as the beaten hull breaks up around you from the incessant pounding.

But that is one threat you no longer need to fear—not when your boat is held together with Anchorfast. Stan Sayres (he owns and drives the world's fastest boat) can tell you: Not even the varnish has cracked where her joints are nailed with Anchorfast.

What is "Anchorfast?" Just about the most revolutionary fastener you ever did see (at right). Once you drive it in, it can split the handle of a claw hammer before it budges a thread.

Anyone could see what a wonderful idea it was when the manufacturer came to INCO with his question: "What metal?"

It had to be strong and tough for holding power, of course. And hard and stiff so you could drive it into hard wood without bending. Yet so rust-free and durable that it would outlast wood. Not too expensive either, mind you, for Anchorfast would sell in competition with ordinary brass screws.

Monel fulfilled every requirement as if it had been an INCO Nickel Alloy especially made for Anchorfast.

Then came INCO's Customer Cooperation to help Independent Nail & Packing Co. find markets and spread the news of their Monel Anchorfast. (Come to think of it, this advertisement itself is an example of that cooperation.)

Today you find Anchorfast in boats from "Slo-Mo-Shun IV" down to slow plodding work boats, in cooling towers, catwalks, mushroom trays—for any NPA-approved use where joints must stay tight as long as the wood lasts.

Does Anchorfast remind you of a metal problem in some product of your own? Let's talk it over. The International Nickel Company, Inc., 67 Wall Street, New York 5, N. Y.

The holding power of Monel Anchorfast comes from its unique "biting tooth" design. The wedged wood fibers lock into the grooves like dozens of tiny vises. Like to try it yourself? Write for "Anchorfast Test Sample."

Inco Nickel Alloys

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Low Carbon Nickel • Duranickel®
Inconel® • Inconel "X"® • Inconel "W"®
Incoloy® • Nimonic® Alloys

MECHANICAL ENGINEERING

Published by The American Society of Mechanical Engineers

VOLUME 75 NUMBER 8

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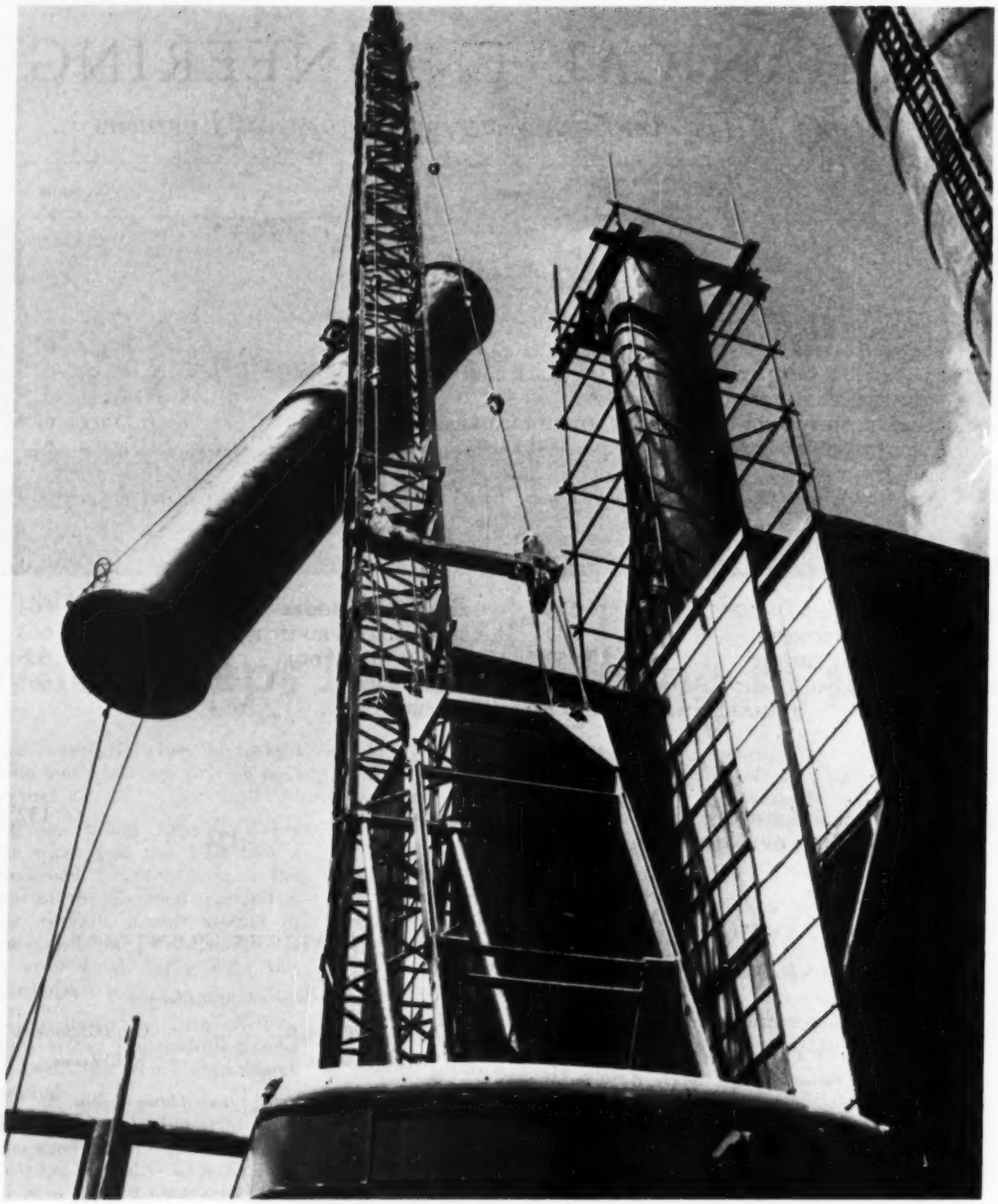

First Glass-Lined Steel Smoke Stack

Developed and erected by A. O. Smith Corporation, Milwaukee, Wis., this three-ton section, 44 ft in length and 6 ft in diameter, is being hoisted aloft by a 120-ft boom crane to form the top section of an 85-ft powerhouse stack at the company's Milwaukee plant. The stack section is coated inside and out with two glass linings, each approximating 0.005 in. in thickness. The bonding of these linings took place at 1600 F. Special acid-resisting glass manufactured by the company's ceramics experts will combat the normal corrosion of metal caused by acid condensate in the smoke.)

VOLUME 75
NO. 8

MECHANICAL ENGINEERING

AUGUST
1953

GEORGE A. STETSON, *Editor*

Philosophy for Engineers

THE University of Detroit has recently announced that "engineering students will be required to complete a sequence of philosophy courses beginning with the pre-senior year in 1953-1954. . . . The sequence will comprise logic, philosophy of life, and moral philosophy."

There can be no question that logic is an appropriate study for engineers. It is defined as "the science that deals with causes and criteria of validity in thought and demonstration," and as such it is basic to the scientific method by means of which engineers analyze their problems, sort out and test facts, and synthesize results into workable knowledge.

It is not so long ago that the field of knowledge now known as science was called natural philosophy. Students of the humanities and arts received the degree of bachelor of arts, and students of science the degree of bachelor of philosophy. Today we have a comforting feeling of assurance that in the field of natural science we are dealing with demonstrable facts, with measurable quantities, with predictable and reproducible experimental results, aided by mathematics—"Number, queen of all the arts." In the other great areas of philosophy which consider questions of the man's self, his place and purpose in the scheme of things, his conduct, morals, and social and political relationships, this comforting feeling of assurance appears to dissipate in the conflict and confusion of different and opposing schools of thought. The ideologies which have stemmed from the writings of philosophers have so influenced systems of government and individual and public morals as to bring into conflict their basic principles which, to those who hold them, are dearer than life itself. But confusing as the study of the writings of philosophers may be, the scientist and the engineer should, above all people, recognize in them the same continuous revision of hypothesis to fit the known facts that has existed and is taken for granted in their own field of natural philosophy.

Gano Dunn

IN THE death on April 10, 1953, of Gano Dunn, The American Society of Mechanical Engineers lost one of its most distinguished and beloved members. If he succeeded in a long, rich, and fruitful life of service to his fellowmen to a greater degree than the rest of us can ever hope to aspire to, it was because of the qualities of heart and mind which he discovered within himself and nurtured in the daily exercise of whatever tasks his profession and his conscience set before him.

The great crisis of his schooldays (the death of his father threatened to rob him of the college education he desired) he met with fortitude, determination, and self-reliance. That education he acquired the hard way, turning to practical use a boyhood hobby of telegraphy by working at night as a Morse Code operator for the Western Union. Many years later, at a Newcomen dinner in honor of Western Union, he stated, with an intensity of emotion which testified to the sincerity of his remarks, that Western Union had been to him like a second father by making it possible for him to go to college, and that he could never pass a telegraph office without subconsciously translating into words the dots and dashes being tapped out by the instrument. His undergraduate studies were completed at the College of the City of New York in 1889; and in 1891 he was the first to receive the degree of EE at Columbia.

With the completion of his formal education, Mr. Dunn's employment with Western Union ceased also, and he entered the service of the Crocker-Wheeler Company, where he advanced from engineer to chief engineer, and later to vice-president and eventually, director. In 1911 he became associated with J. G. White and Company as vice-president in charge of engineering and construction and in 1913 became president, a position he held until his death.

The engineering achievements of Mr. Dunn's long career were numerous and varied and of high quality. They will not be listed here. They represent but one phase of his activities. They were brilliantly supplemented by the distinguished services he rendered on behalf of the engineering profession, the cause of education, a long list of engineering, scientific, and learned societies, and the nation, state, and city.

Elected president, The Cooper Union for the Advancement of Science and Art in 1935, he continued throughout the remainder of his life to exercise there his extraordinary talents for administration, leadership, and wise counseling. He served also as trustee of Barnard College and Columbia University, as a member of the Visiting Committee, Harvard Engineering School, and as a trustee of the Cathedral of St. John the Divine. At various times during his career he was president of the New York Electrical Society, the American Institute of Electrical Engineers, and United Engineering Society; vice-president, International Electrical Congress, Turin, 1911; chairman, The Engineering Foundation, National Research Council, Visiting Committee of the National Bureau of Standards, and the State Department, Special Committee on Submarine Cables, 1918; secretary, Electric Lighting and Distribution, International Electrical Congress, St. Louis, 1904;

delegate, Second Pan-American Engineering Congress, Washington, 1915; U. S. delegate, Third Pan-American Commercial Conference, Washington, 1927; U. S. delegate and member of Executive Committee, World Power Conference, 1936, and chairman of American Committee, World Power Conference, 1946; member, New York State Committee on Technical Industrial Development since 1944, President's Committee on Civil Service Improvement, 1939, Patent Office Advisory Committee, 1939–1941, Mayor's Business Advisory Committee, City of New York, Business Advisory Council for Department of Commerce, Science Advisory Board, 1932–1936, and New York State University Commission, 1947; special consultant on power and steel, Office of Production Management, and consultant to the War Department, 1947. In addition to being an Honorary Member of ASME, he was honorary secretary for the United States of The Institution of Electrical Engineers (London), and member or fellow of numerous engineering, scientific, historical, and learned societies and a director of many business enterprises. He received many honors, including the Hoover, Edison, Townsend Harris, Egleston, and Peter Cooper medals and a number of honorary degrees.

Gano Dunn's long life was one of dedicated service in which he developed every latent talent within him. More than a dozen years ago, F. B. Jewett said of him, "Outside his summer in his sailboat, his one avocation is public service. . . . Within the limits of his physical endurance he never says 'no' to any request of a helping hand in anything which he thinks is really worth doing." What better tribute can any man receive.

Lewis F. Moody

LEWIS F. MOODY, Honorary Member ASME, teacher, and hydraulic engineer, who died on April 18, 1953, at the age of 73, lived in the golden era of that branch of engineering to which he made so many important contributions. To us, who know little or nothing about life without electricity and who have grown familiar with great hydroelectric developments, it seems incredible that, when Moody was in his teens, the greatest engineering minds of the world were attempting to decide how the water power at Niagara should be developed. Schemes for building multiple factories, each with its own hydraulic turbine, and power transmission by ropes and pulleys and by compressed air, were set aside in favor of turbine-driven electric generators in units of 5000 hp. From that time on the design of large hydraulic turbines presented a myriad of engineering and technical problems, and efficacies climbed so high that progress had to be measured in tenths of a per cent. Niagara opened up opportunities for research and design in hydraulics which Moody was to tackle later in other great hydroelectric plants.

Moody started his engineering career as a teacher at his Alma Mater, the University of Pennsylvania, but soon entered employment with I. P. Morris Company of Philadelphia on the staff of its hydraulic division. Four years later, in 1908, he was once more engaged in teaching, this time at Rensselaer Polytechnic Institute where he assisted in planning the curriculum and the mechanical engineering and hydraulic laboratory. As a professor of hydraulics he was frequently engaged in consulting work and after 1911 half of this time was spent as consultant to the I. P. Morris Company. By 1916 his full time was required by the Company and he abandoned teaching until 1930, when he was called to Princeton University as professor of hydraulic engineering, a post he held until retirement came in 1948. Throughout the years at Princeton, Moody continued to devote one quarter of his time as a consultant to the Baldwin Locomotive Works, the successor of the I. P. Morris Company, and, from 1938 to 1949, to the Worthington Pump and Machinery Corporation also.

In the dual role that Moody played in teaching and as a consultant, his engineering competence matured with the opportunities and experiences which classroom and laboratory afforded on one hand, and the design and construction realities which are the sound substance of practice on the other. From each field he drew the materials with which he enriched his contributions to the other.

Not only hydraulic turbines, but centrifugal pumps were subjected by Moody to tests and analysis to improve performance. In his laboratory he studied all kinds of hydraulic phenomena, such as cavitation, his internationally known "step-up formula" for hydraulic turbines and pumps, losses in draft tubes, water-hammer theory, and the shapes of water passages. He tested for efficiency models of Francis turbines of 115,000 hp for Hoover Dam and 80,000 lb for the Tennessee Valley Authority. More than 90 patents resulted from his work, including those for a diagonal propeller turbine, a spiral draft tube, the Moody spreading draft tube, the Moody spiral pump, and several for high specific speed turbines.

At Princeton, Moody's principal courses were hydraulic power and machinery, advanced hydraulics, and machine design. From these activities came his textbook "Lectures on Machine Design" (1942) and a section on hydraulic machinery in the "Handbook of Applied Hydraulics" (1942). He presented many technical papers to the ASME, ASCE, Engineers Club of Philadelphia, *Zeitschrift für des gesampte Turbinenwesen*, and *La Houille Blanche*. A member of several engineering societies, he joined ASME in 1910, became a Fellow in 1944, and was elected an Honorary Member in 1951. He served on the ASME Council as director at large, as chairman of the Hydraulic Division, and as a member of the Power Test Codes Committee. In 1945 he was awarded the Elliott Cresson Medal of The Franklin Institute.

Among his colleagues Moody had the reputation of possessing "unsurpassed powers of concentration" and a "rare gift of intuition which led unfailingly to a simple and direct solution of the problem in hand." A tribute written shortly after his death states, "Seldom was the exigency of a task so great that some time could not be taken to exercise a modest talent for music and painting and to enjoy the company of friends."

MECHANICAL PUMPS *for* *High-Temperature* LIQUID METAL

By PHILIP M. CLARK

KNOLLS ATOMIC POWER LABORATORY,[1] SCHENECTADY, N. Y.

INTRODUCTION

As a part of the development of nuclear power for submarine propulsion, the author's company designed and built a relatively large heat-transfer test system in which liquid sodium and liquid sodium-potassium were used as heat-transfer media. For this system it was necessary to develop a pump capable of circulating approximately 400 gpm of liquid metal at temperatures up to 750 F and which could tolerate no leakage of liquid metal at the shaft. However, a very small gas leakage was acceptable. Two identical centrifugal pumps were built and both have operated successfully for several thousands of hours.

The design of a suitable pump to circulate liquid metal was complicated by lack of information on liquid-metal corrosion, bearing operation in liquid metal, and high-temperature seals. A design study produced a centrifugal pump with a long overhung shaft and a shaft seal.[2] By this means the problem of bearing operation in liquid metal could be eliminated. To the best of our knowledge, type-347 stainless steel and pure nickel would be sufficiently resistant to corrosion for use on those parts in contact with liquid metal.

The extreme purity requirements of an alkali-metal system made the seal problem the most difficult to solve. The leakage of liquid metal out of the pump had to be absolutely zero. Gas leakage out of the pump and seal gas leakage into the pump had to be kept to a minimum. Even though the inert gas used to blanket the system has a high degree of purity, large quantities passed over the liquid surface would cause oxygen contamination and the cost of maintaining the blanket would be prohibitive.

The detailed design was worked out in cooperation with the Buffalo Pump Company of North Tonawanda, N. Y., where the two pumps were subsequently built. A seal-development program was carried on concurrently with the manufacture of the pumps.

[1] Operated for the U. S. Atomic Energy Commission by the General Electric Company.

[2] Electromagnetic pump development was in progress during this design study and the use of electromagnetic pumps was considered for this application. However, experience was limited to very small-capacity pumps. Consequently, the mechanical pump appeared more readily applicable on a short-range basis.

Contributed by the Hydraulic Division and presented at the Annual Meeting, New York, N. Y., November 30-December 5, 1952, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

DESCRIPTION OF PUMP

The pump is a single-volute radial centrifugal unit with a specific speed of 926 rpm. It is designed to produce 400 gpm at a head of 126 ft and 1750 rpm. An elevation drawing is shown in Fig. 1; views of the pump installation are shown in Figs. 2 and 3.

The pumping elements are contained in a large drain tank pressurized with inert gas while the support bearings and the 20-hp drive motor are located above the floor plate. The drive

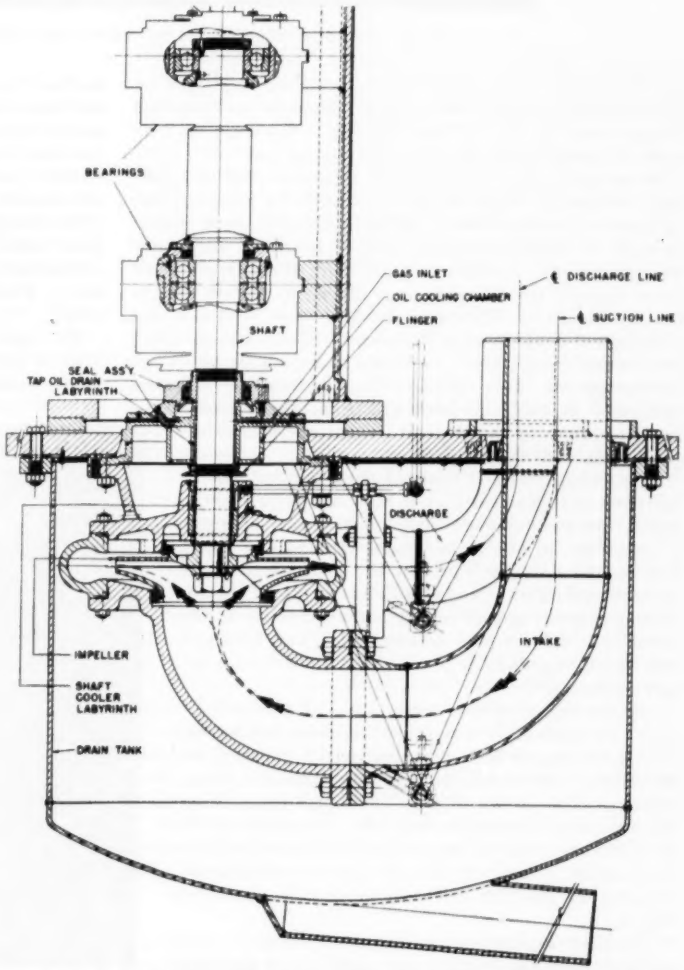

FIG. 1 SECTION THROUGH ALPLAUS MECHANICAL PUMP FOR GENIE HEAT-TRANSFER SYSTEM; 400 GPM, 126 FT HEAD

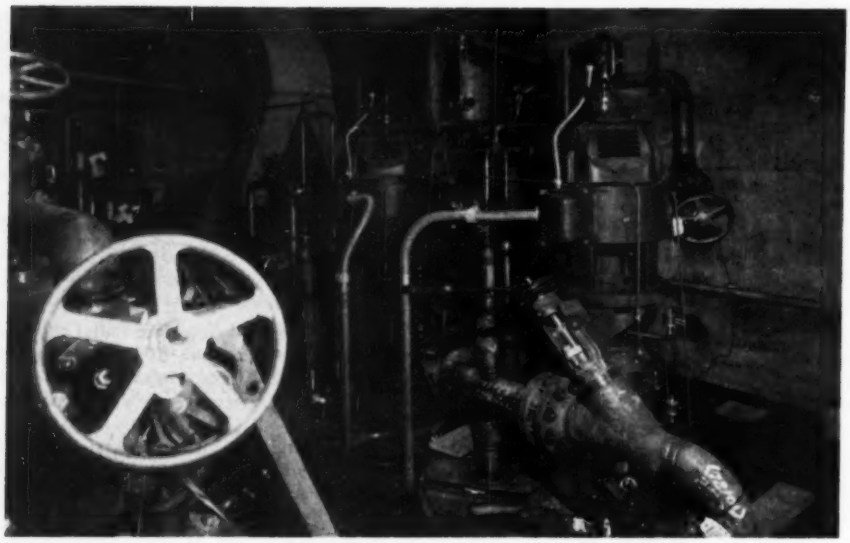

FIG. 2 INSTALLATION VIEW OF PUMP SHOWING PORTION ABOVE FLOOR PLATE

motor is direct-current, driven by a high-current amplidyne for variable-speed control. The support bearings are standard close-tolerance (a.b.e.c.-7) ball bearings. The drain tank returns any pump leakage to the system storage tank.

Immediately above the impeller is a section called the shaft-cooler labyrinth where the shaft is cooled by pumped fluid. Liquid metal is taken from the discharge side of the pump, passed through a heat exchanger, and returned to the pump through the shaft-cooler inlet pipe. Part of the liquid passes down through the labyrinth into the pump suction thereby cooling the shaft. The remainder spills over the top of the bushing and down into the drain tank. This leakage, which amounts to about 1 gpm, is returned to the system by a small electromagnetic filler pump. The shaft-cooler labyrinth then acts to cool the shaft and form the primary liquid seal limiting liquid-metal leakage and preventing gas leakage into the pump suction.

A second labyrinth is mounted above the shaft-cooler labyrinth and separated from it by a flinger to prevent liquid from passing up the shaft. The second labyrinth is cooled by an oil jacket which surrounds it. A gas bleed of about $^1/_2$ cfm is fed into the labyrinth to sweep down liquid-metal vapors that diffuse into it. The oil-cooling chamber acts to cool the shaft and condense any vapor that diffuses into the labyrinth. This labyrinth and oil-cooling chamber provide protection for the gas seal mounted above.

The gas seal itself is a rotary face seal of Sealol[3] design. It consists of a stationary carbon element and secondary silicone rubber packing which provides for flexibility. The carbon element runs against a flinger which rotates on the shaft. The flinger deposits any oil that passes through the seal into a trap provided for it. This trap may be drained periodically through the hole which is shown in the seal adapter. An enlarged drawing of the complete seal adapter is shown in Fig. 4.

The shaft is designed considerably oversize so that the long overhang will not cause deflection in the shaft-cooler bushing where the radial clearance is 0.0055 in. Further, the stresses in the shaft and impeller are kept to a minimum so that the pump will not be damaged due to short-period over-temperature operation. It has been calculated that the pump will heat up due to "egg-beater" action from 725 F to 1500 F in about 3 minutes should the pump discharge be shut off completely.

The pump shaft, the drain tank, the floor plate, and all the parts within the drain tank with the exception of the shaft-cooler bushing and the gaskets are made of type-347 stainless steel. The shaft-cooler bushing and the gaskets are made of nickel.

The shaft has a stellite facing opposite the shaft-cooler bushing and all bolts have a hard nickel-plate or nitrided surface to prevent galling.

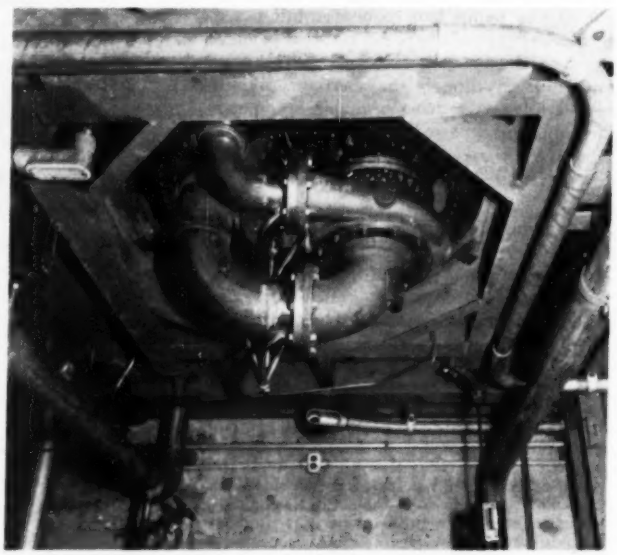

FIG. 3 INSTALLATION VIEW OF PUMP LOOKING UP AT THE PUMPING ELEMENTS WITH THE DRAIN TANK REMOVED

[3] Sealol Corporation, Providence, R. I.

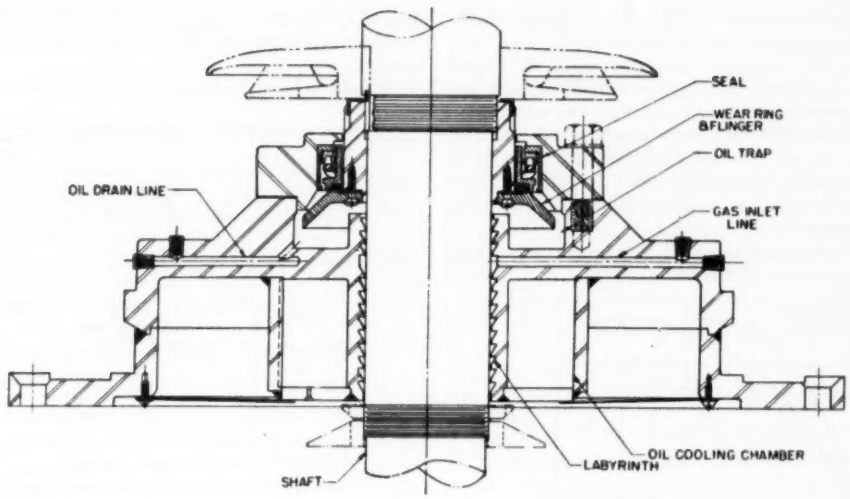

FIG. 4 SEAL ADAPTER

SEAL DEVELOPMENT

Packings. The pumps were originally designed to operate with shaft packing for a seal. The main advantage of packing is the facility with which it can be removed and replaced without disassembly of the pump or opening of the liquid-metal system. Several metallic and soft packings were tested. Owing to the cleanliness required in the liquid-metal system, very little lubrication could be permitted. The use of solid lubricants (graphite and molybdenum disulphide) was investigated. Since only small quantities could be added to the packing, the effectiveness of solid lubricants was limited to the period that the lubricant would remain impregnated in the packing or held between the shaft and packing. Liquid lubricants remained for shorter periods and quickly oxidized or vaporized making them totally undesirable. Essentially, then, the packings had to run dry. Operating periods were limited to the length of time that lubricant remained in the packing plus a short period of dry operation (with associated high torque and leakage) until the packing seized the shaft. Soft packings (generally asbestos with various binders and impregnants) operated somewhat more successfully and provided lower leakage rates but failed in the absence of lubrication. Leakage rates for packings in all combinations generally were in excess of 10 standard cu ft per hr at a pressure of 15 psig. The set limit for the liquid-metal systems was less than 1 standard cu ft per hr of gas. The packing life during the tests was limited to a maximum of about 100 hr.

Rotary Face Seals. Considerable improvement in the leakage rate was obtained when the development switched to rotary face seals. A leakage of less than 0.1 cfh can be expected with this type of seal. The chief disadvantage of this seal is the fact that the pump must be disassembled completely in order to replace the seal. Consequently, the seal must be durable.

The Sealol seal was selected and employed for most of the test work because of its compactness, simplicity of design, and adaptability to the pump. The problem resolved itself into a question of carbon durability and compatibility between the stationary carbon element and the revolving seal ring or flinger on the shaft. In order to effect the low leakage rates mentioned, it was found necessary to lap both the carbon and wear-ring surfaces very flat. All rings were lapped to less than three light bands and in most cases less than one. A good surface finish also is required. Most of the wear rings averaged about 1 microinch surface roughness. A surface measuring over 2 microinches was rejected. Both these conditions were accomplished by the use of a diamond-grit-impregnated lapping plate (the diamond grit is pushed into the surface of the lapping plate and the excess wiped off. By this means no abrasive particles are transferred to the piece being lapped). Any loose abrasive-lapping process resulted in abrasive-particle penetration of the metal wear ring or carbon-seal element, thereby causing a lapping action during seal operation. For soft materials and cast iron the loose abrasive-lapping methods resulted in short seal lives.

Face seals under test operated from 45 hr to 1332 hr in a dry condition before failure.[4] Test runs generally were continued up to a maximum of 250 hr and then the life of the seal extrapolated on the basis of the wear rate. A silver-impregnated carbon material produced the best results operating dry against a nitrided surface.

Because of these poor wear rates, it was decided to compromise and use minute quantities of oil to lubricate the seal. This improved seal life a great deal. The trap in the seal adapter was considered adequate if kept drained. The quantity of oil added to the seal amounted to about 30 drops in 24 hr added at regular intervals. Under these conditions extrapolated seal lives varied from about 1000 hr to "indefinite" (no measurable wear at the end of the run). The best materials under these conditions were Graphitar No. 39 and the silver-impregnated material (Morganite MY1F). The best wear-ring materials were a hardened tungsten-molybdenum tool steel or a nitrided surface (on a 300 series stainless steel or nitralloy).

Test results indicated that there were discrepancies in wear rates within any one grade of carbon despite the fact that the exact test conditions prevailed. For this reason a screening-test program, consisting of a 100-hr test run, has been set up to eliminate those seals which have doubtful durability. It has been found that this 100-hr test run provides a very good indication of the durability of the seal.

PUMP OPERATION

After the manufacture of the pumps was completed, water tests were run to determine the pump characteristics. The

[4] Complete information on the test runs may be obtained from the author if desired.

results of these tests are shown in Fig. 5. A comparison of water and sodium-potassium data is shown in Fig. 6. The sodium-potassium data compare favorably with the water data. The slight discrepancies shown are within the accuracy of the instrumentation on the sodium-potassium system. Characteristic data at 1750 rpm were unobserved because of pressure-gage limitations. Characteristic data on the sodium system were not readily obtainable when the sodium-potassium-system data were taken because of frozen or oxide-plugged pressure gages.

In general, the pumps have operated well for the purpose for

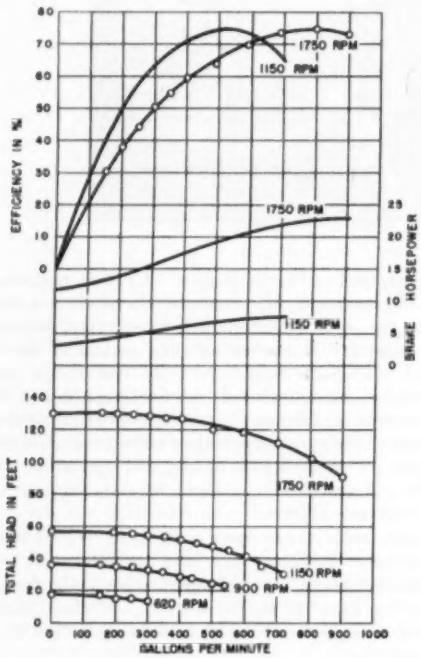

FIG. 5 WATER-TEST RESULTS

which they were designed. No liquid-metal corrosion has taken place on any of the parts in contact with liquid metal. However, when liquid metal or vapor came in contact with the carbon-seal element, failure of the seal occurred shortly thereafter. Difficulty was experienced with one inlet-elbow casting where mold sand had penetrated the metal during casting. During subsequent liquid-metal operation, the sand reacted violently with the liquid metal to form a spongy layer of stainless steel on the surface of the casting.

The shaft-cooler bushing functioned satisfactorily as a primary liquid seal but was found unnecessary as a heat dam both because of the poor heat conductivity of the stainless-steel shaft and the effectiveness of the oil-cooling chamber. Shaft cooling by this method was found to be difficult because cooling the liquid metal from stream temperature to the desired shaft temperature caused deposition of dissolved oxides in such a manner as to plug the heat exchanger and shaft-cooler lines. However, cooling can be effected by this means and may be useful, without large temperature differentials, for operation at higher temperatures.

Metal-to-metal contact was encountered in the shaft-cooler bushing causing considerable scoring but was not serious enough to cause operational difficulties. Impeller thrust, dynamic vibrations, and thermal distortions were the causes of these metal contacts. No galling or shaft-balance difficulties resulted.

Additional heat was found necessary in the cavity below the

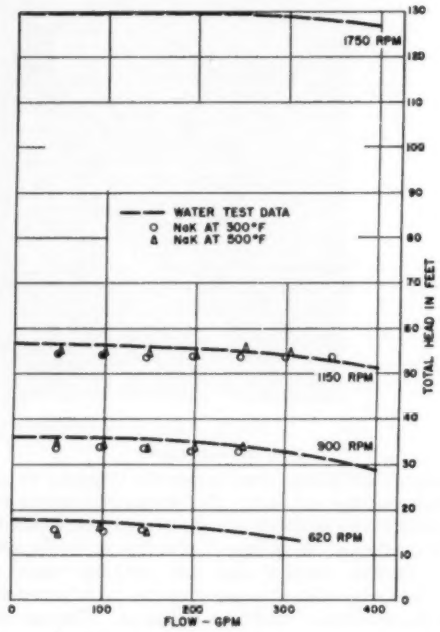

FIG. 6 COMPARISON OF WATER AND SODIUM-POTASSIUM DATA

seal adapter in the sodium pump because a frozen cake built up there and plugged the drain holes. A coiled calrod was added.

On several occasions it has been necessary to replace seals. The seal failures have been due to one or a combination of the following reasons:

1 Liquid-metal corrosion of the carbon.

2 Secondary silicone-rubber packing failures (as a result of oil contamination).

3 Foreign materials (dirt, grit, and so on).

4 High temperature causing:

(*a*) Differential expansion between the carbon and seal ring.

(*b*) Oxidation and decomposition of the oil in the seal (automotive motor oils operated most satisfactorily).

(*c*) Warping of the accurately machined surfaces resulting in a leak.

The experience gained in operating the pumps has presented the difficulties cited and enabled the seal life to be increased by adequate protection of the seal. The seal-maintenance problem has not been as difficult as originally anticipated. An average seal life of more than 2000 hr has been attained and is expected to improve considerably. Many thousands of hours of successful operation have been experienced over a period of $2^1/_2$ years.

CONCLUSIONS

1 A pump of this design is adequate for pumping high-temperature liquid metals up to 750 F.

2 Seal life averages more than 2000 hr and is improving with experience.

3 Shaft cooling with pumped fluid is unnecessary at 750 F.

Dimensional Tolerances for Steel Castings

By CHARLES W. BRIGGS

TECHNICAL AND RESEARCH DIRECTOR, STEEL FOUNDERS' SOCIETY OF AMERICA, CLEVELAND, OHIO. MEMBER ASME

THE high-strength values of steel, as well as its excellent dependability, have made steel castings one of the foremost materials of construction. The high-strength values of steel have made it possible for designers to use thinner sections in comparison with other materials. At the same time the high modulus of elasticity of steel assures rigid castings resistant to high deformation loads with minimum deflection resulting in accurate alignment, close tolerances, and good fit.

SPECIFICATIONS

Specifications for structural and engineering grades of steel castings are based, primarily, on mechanical property minimums rather than on chemical limitations such as the SAE and AISI series of steels. The customer indicates what properties he desires and the steel foundry uses the best combination of chemical elements, in its opinion and experience, to produce the properties required.

Purchasers and manufacturers of steel castings have set up, under the auspices of the American Society for Testing Materials, a number of steel-casting specifications. This group acting together unites the best knowledge obtainable, resulting in carefully prepared and workable specifications. These ASTM steel-casting specifications are as follows:

A 27-50T—Mild to Medium Strength Carbon-Steel Castings for General Application

A 148-50T—High-Strength Castings for Structural Purposes

A 95-44 —Carbon-Steel Castings for Valves, Flanges, and Fittings for High-Temperature Service

A 216-47T—Carbon-Steel Castings Suitable for Fusion Welding for Service Up to Temperatures of 750 F

A 217-49T—Alloy Steel Castings for Pressure Containing Parts Suitable for High-Temperature Service

PATTERN TOLERANCES

In some cases, purchasers of steel castings construct or have constructed for them the pattern equipment of a part. However, prior to submitting the pattern to the steel foundry, it is believed advisable that information on pattern construction should be presented. Incidentally, it is good practice to consult with the steel foundry regarding pattern construction.

Pattern Construction. A suggested guide is presented in Table 1 concerning construction material for patterns for steel castings. The material used for pattern and core-box construction will depend mostly on the number of castings desired on the order and for future orders.

Patternmaker's Shrinkage Tolerances. Shrinkage allowance for patterns is the correction which must be made for the change of dimensions as the solidified casting cools in the mold from the freezing temperature of the metal to room temperature. This contraction is commonly known as patternmaker's shrinkage. The contraction effect is compensated for by making the pattern larger by the amount of shrinkage characteristic of the metal used, the casting design, and mold construction employed.

The molding methods employed by two foundries may be so different that entirely different shrinkage allowances would be required by each for the same pattern. Also, the casting design may be such that, because of hindered contraction, it is possible to have in one pattern several different shrinkage allowances.

Patternmaker's shrinkage is usually reported in fractions of an inch per foot; therefore shrinkage values vary from $^{9}/_{32}$ to $^{1}/_{16}$ in. per ft.

The figure often used is $^{3}/_{16}$ in. per ft, but its universal adoption would lead to trouble and errors in casting dimensions and tolerances.

The purchaser of steel castings who builds his own patterns should be careful in the use of tables purporting to give patternmaker's shrinkage. The best policy is to discuss the question of patternmaker's shrinkage values with the foundry that is to make the castings, or better still, to allow the foundry to construct the pattern.

Draft.[1] Draft is the taper which must be allowed on all vertical faces of a pattern to permit its removal from the sand without tearing the mold walls. Regardless of the type of pattern equipment to be used, draft must be considered in all casting designs. In cases where draft may affect the subsequent use of the casting, the drawing should specify whether this draft is to be added to or subtracted from the given casting dimensions.

The necessary amount of draft depends upon the size of the casting, the method of production, and whether molding will be by hand or machine. Machine molding will require a minimum amount of draft. In green-sand molding, interior surfaces usually require more draft than exterior surfaces. Under normal conditions, the amount of draft recommended is not less than 1 deg or approximately $^{1}/_{16}$ in. per ft. This allowance

TABLE 1 CONSTRUCTION MATERIAL FOR PATTERNS[a]

Number of castings	Material
	Small castings—under 24 in. largest dimension
1 to 99	Soft or hardwood patterns and core box
100 to 499	Hardwood, metal, or combination patterns and core boxes. Wood core boxes must be metal-faced
500 and up	Metal patterns and core boxes. Plastic match-plate patterns
	Medium castings—up to 72 in. largest dimension
1 to 49	Softwood patterns and core boxes
50 to 249	Hardwood patterns with wearing surfaces metal-faced. Core boxes metal-faced
250 and up	Combination hardwood and metal or all-metal patterns and core boxes
	Large castings—over 6 ft largest dimension
1 to 24	Softwood patterns and core boxes
25 to 99	Softwood patterns with exposed projections, metal-faced. Boxes are to be of softwood, metal-faced
100 and up	Hardwood patterns, metal-reinforced. Hardwood core boxes, metal-faced

[a] This table is presented only as a suggested guide and should not be considered as a definite recommendation.

Contributed by the Metals Engineering Division and presented at the Fall Meeting, Chicago, Ill., September 7–11, 1952, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Condensed.

[1] "Cast Metals Handbook," American Foundrymen's Society, 1944, pp. 4–17.

normally would be added to design dimensions but an effort should be made to maintain metal thickness.

CASTABILITY

Minimum Section Thickness. The rigidity of a section often governs the minimum thickness to which a section can be designed. There are cases, however, when a very thin section will suffice, depending on strength and rigidity calculations.

The fluidity of steel in comparison with other metals is known to be of a lesser value. In order that sections be completely run it is necessary that a minimum value of section thickness be adopted.

Metal cools as it runs in a section through a mold; thus a thin section close to the gate which delivers the hot metal will run whereas the same thin section at a distance from the gate may not run. Since the design engineer has no knowledge of the location of the gate a minimum thickness of $^1/_4$ in. must be suggested for design use.

It should be pointed out that steel flows best for a given thickness in a narrow rather than in a wide web. If the $^1/_4$-in-thick section is longer than 12 in. then the minimum thickness should be increased in accordance with the values in Fig. 1.

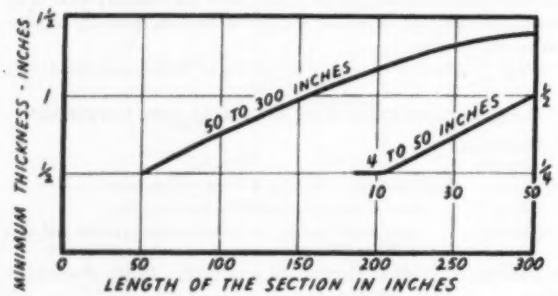

FIG. 1 MINIMUM THICKNESS OF SECTIONS AS A FUNCTION OF THEIR LARGEST DIMENSION

The curve of this chart represents the best of design conditions wherein molten steel enters at one position on the casting and must run the lengths prescribed on the chart. Provisions may be made by the foundryman through the application of special techniques to pour even longer members through thinner sections than indicated by the graph. However, the applications of special techniques are usually responsible for increased costs of production.

CASTING DIMENSIONAL TOLERANCES

Casting Finish Tolerances. Casting dimensional tolerances are closely aligned with patternmaker's shrinkage, and the hindering of the contraction of steel castings through mold and casting resistance. These modifying influences must be understood in order to appreciate the limitations that should be placed on any table devoted to dimensional tolerances. However, studies on free and hindered contraction have assisted steel foundrymen in setting up practical values which can act as guides to engineers concerning those tolerances which may be expected on steel castings that are not machined. The tolerance values have been based on the longest dimension of the casting. It is realized that length is not the controlling factor but nevertheless the use of the largest dimension is a convenient value for ready use to the engineer.

If the engineer will remember that the tolerance may vary, depending on the type of hindered contraction encountered, then Table 2 on dimensional tolerances will be useful.

It is suggested that the average value be employed and in no case should a value below the minimum be used. The concise value is one which could be employed on casting designs that have been made by the foundry, and because of their experience with this particular casting design a concise value can be met and maintained.

TABLE 2 DIMENSIONAL TOLERANCES FOR STEEL CASTINGS THAT ARE NOT TO BE MACHINED

Tolerance	Smaller than 12 in.	Between 12 and 36 in.	Between 36 and 120 in.
Average	$0.06 + 0.006D$[a] $^1/_{16}$ in. min	$0.06 + 0.006D$	$0.08 + 0.006D$
Concise	$0.04 + 0.005D$ $^1/_{16}$ in. min	$0.05 + 0.005D$	$0.07 + 0.005D$
Minimum	$0.03 + 0.004D$ $^1/_{16}$ in. min	$0.04 + 0.004D$	$0.06 + 0.004D$

[a] Where D = longest dimension of casting, in.

Section Thickness Tolerances. Steel castings, which incorporate low factors of safety and are critically designed for maximum-strength weightsaving structures, may have specified restrictions regarding certain or all casting sections of the part. This tolerance is ±5 per cent of the casting section for castings having sections up to 2 in. The section thickness tolerance is ±10 per cent in sections greater than 2 in., or large heavy castings.

Weight Limitations. Tolerances for weight limitations are specified only on castings that have been cast previously and a weight established. The reason for this is that estimated weights are often at considerable variance with actual weights. After the weight has been established on a particular casting, this weight will not vary by ±10 per cent.

Machine-Finish Tolerances. The tolerance to be added to the casting section for machining purposes will depend entirely on the design of the casting. For example, a ring gear may require a greater machine-finish tolerance than a spoked gear. The reason for this again goes back to the possible hindered contraction stresses that may be acting on the casting while it cools to room temperature. Also, certain faces of a casting may require more tolerance than others primarily resulting from their position in the mold during casting. A face that is uppermost in the mold (cope face) usually will require more machine-finish tolerance than the bottom or drag face. The reason for this is that, because of design faults or other reasons, loose sand is sometimes encountered in the pouring of the mold, and when this happens it floats upward and lodges in the cope face of the casting.

Again, definite values of machine-finish tolerance cannot be

TABLE 3 GUIDE TO MACHINE-FINISH TOLERANCES

Casting diameter, in.	Machine allowance on outside radius, in.
Rings, spoked wheels, spoked gears, circular-shaped castings	
Up to 18	$^1/_4$
18 to 36	$^5/_{16}$
36 to 48	$^3/_8$
48 to 72	$^1/_2$
72 to 108	$^5/_8$
108 and up	$^3/_4$
Bores	
Bore diameter, in.	Machine allowance on bore radius, in.
Up to 1	Cast solid
2 to 7	$^1/_4$
7 to 12	$^3/_8$
12 to 20	$^1/_2$

established for all casting designs, but guides can be suggested to designers. Such guides have been prepared and are presented in Table 3.

Location Points. Locating spots[1] to be used by the machine shop are important items frequently neglected until the casting is made. When possible, they should be indicated on the drawing so that castings may be checked satisfactorily, always from the same reference point, by the pattern shop, the foundry, and the machine shop. An effort should be made to place them on the same side of the parting line. They should be located so that they will not be influenced by a shift of a core, the cope, or the drag. The points should be as far apart as the size of the casting permits, as this will insure the most accurate results. Dimensions, which have no finish allowances and are to be held to close limits, should be considered as the proper place from which to start development of tooling fixtures.

Tolerances and Specifications of MALLEABLE CASTINGS

By JAMES H. LANSING

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GOOD malleable-casting design will accomplish a threefold purpose: (1) It will make for full use of the inherent properties of malleable iron, (2) it will make for economy in manufacturing, and (3) it will produce parts which will function most satisfactorily under service requirements.

Close co-operation between the engineer and the foundryman is of fundamental importance. By consultation between them, while the work is in the formative stages, design often can be simplified, casting difficulties can be avoided, production costs can be reduced.

With malleable-iron castings, as well as with most other products, a pleasing appearance is basic to good design. This provides for a smooth blending of one section of a part into the others, as in Fig. 1, showing an automotive steering-gear housing.

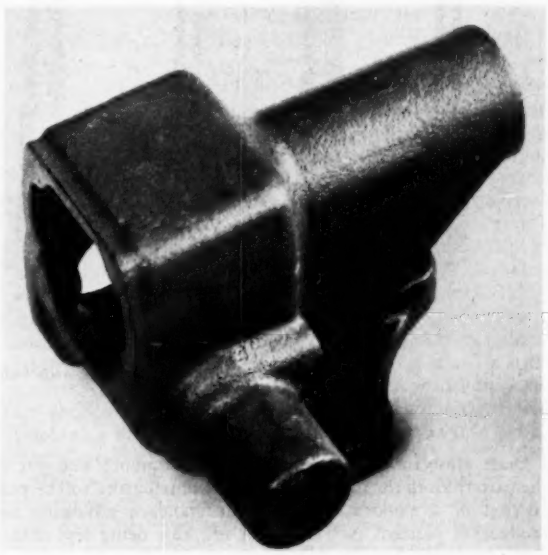

FIG. 1 AUTOMOTIVE STEERING-GEAR HOUSING

MATERIAL

Of at least equal importance to the engineer-designer are the properties which the material under consideration actually possesses. In a paper presented at the International Foundry Congress at Brussels[1] the design importance of uniformity of structure was stressed. The structures of some materials depend upon their solidification characteristics. There may be segregation, varying amounts of combined carbon, and varying mechanical properties, depending upon the thickness of section and/or the rate of cooling, as possibly also influenced by cores or other factors. Under such conditions, when sections of varying thickness are included in one part, greatly varying properties may exist in the different areas.

In the case of malleable iron, however, the white-iron castings, from which malleable is made, have all of their carbon in the combined form. Following the malleabilizing or heat-conversion process, all of their carbon is in the free, nodular, temper-carbon form. With the exception of an unimportant decarburization at the surface, the structure of malleable is uniform throughout—a matrix of ferrite in which are interspersed nodules of temper carbon.

Recently, the question was raised as to the effect of machining on the test values of malleable iron. This prompted the machining of six bars, selected at random from various heats, to 0.505 in. diam from their original as-cast 0.645 in. diam. With this reduction of more than 22 per cent in diameter and of 38 per cent in area, their results as compared with companion unmachined bars are given in Table 1. The specimens are shown in Fig. 2.

The as-cast and annealed malleable bars, slightly over $^5/_8$ in. in original diameter, are seen to give equally good properties when machined to approximately $^1/_2$ in. diam. This demonstrates the uniformity of material on which the designer may rely.

In addition, tests made by the Massachusetts Institute of Technology and the Link-Belt Company established the fatigue-endurance ratio of malleable to be in excess of 50 per cent and the notch-fatigue ratio to be the relatively high value of 33 per cent.

[1] "Important Attributes of Malleable Iron," by James H. Lansing, International Foundry Congress, Brussels, Belgium, 1951.

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TABLE 1 ROUGH AND MACHINED-BAR COMPARISONS

Bar no.	As-cast malleable bars, 0.645 in. diam: Ultimate strength, psi	Yield point, psi	Elongation in 2 in. per cent	Machined malleable bars, 0.505 in. diam: Ultimate strength, psi	Yield point, psi	Elongation in 2 in., per cent
3-28	54200	35600	23.0	52000	35500	22.0
3-29	55500	37100	21.5	55000	37000	22.5
4-3	55700	37300	23.0	55750	39000	22.0
4-4	55400	36800	23.0	53750	37000	23.0
4-5	57600	38400	25.5	56000	38500	21.0
4-9	59000	39800	27.0	58750	40000	23.0
Average	56230	37500	23.8	55210	37830	22.6

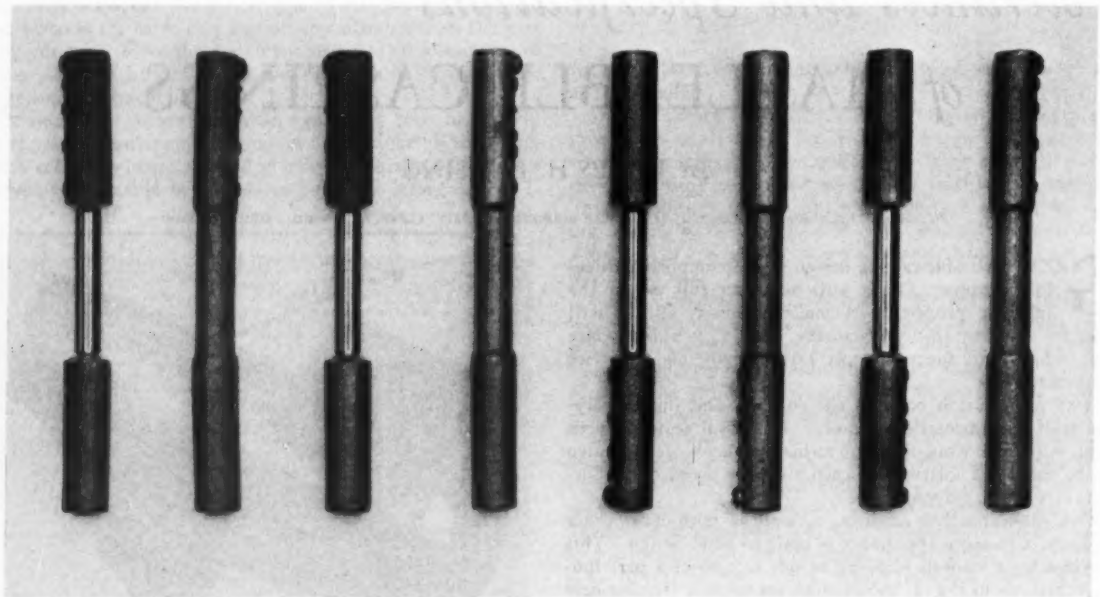

FIG. 2 FULL-SIZE AND REDUCED-DIAMETER TEST SPECIMENS

TOLERANCES

Draft allowance is necessary to permit smooth removal of the pattern from the mold, this in turn contributing to the production of a smooth casting. The standard advisable for production patterns is $^1/_{64}$ in. per in., this being less than 1 deg as compared with 7 deg in some production processes. In certain cases $^1/_{32}$ in. is recommended for the first inch, $^1/_{64}$ in. per in. thereafter. If loose patterns are employed, the allowance should be substantially greater, for example, approximately $^1/_4$ in. per ft for loose patterns with a deep draw. In any event, the specification should be clear: If a minimum of taper is required, it should be specified; when a reasonable draft can be allowed, it should be noted. Design tolerances should be marked on the drawing which also should be marked for locating points and close clearances, of importance in assembly. Where possible, a casting drawing rather than a machine drawing should be supplied.

In general, size tolerances should be at least one half the maximum shrinkage allowance for the metal involved. Malleable shrinkage allowance is normally $^1/_8$ in. per ft, on which basis the size tolerance would be $^1/_{16}$ in. per ft. Where extreme accuracy is necessary, malleable-iron castings are furnished die-straightened, the straightening being done by means of a press or drop hammer. Satisfactory results can be obtained by either method when the quantity in production justifies the cost of the necessary dies. The straightening can be carried beyond the point of merely assuring uniformity for jigging or chucking, to actually coining the casting to finish dimensions. Fig. 3 shows an $11^1/_2$-lb malleable casting with coin-pressed flange and four punched holes. By coining, it is possible to hold small castings to ± 0.007 in.

FINISH ALLOWANCES

The nature of the finishing operation to be used on a casting determines the finish allowance which must be incorporated into the design. Since malleable iron machines more easily than most other ferrous metals, generous finish allowances

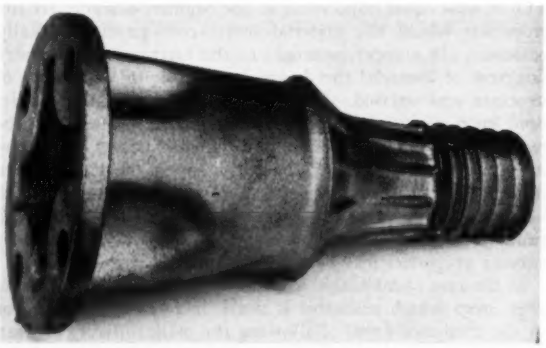

FIG. 3 MALLEABLE CASTING WITH COIN-PRESSED AND PUNCHED FLANGE

do not necessarily mean increased finishing cost. For castings which are not press-straightened, recommended allowances would be as follows:[2]

For milling—$^1/_{16}$ to $^3/_{32}$ in. for small castings, $^1/_8$ to $^3/_{16}$ in. for medium castings, and somewhat more for large castings.

[2] "American Malleable Iron—A Handbook," Malleable Founders Society, 1944.

For reaming—$^{3}/_{32}$ in. on the diameter for cored holes under 1 in., $^{1}/_{8}$ to $^{3}/_{16}$ in. on the diameter for medium holes, and more for larger holes.

Allowances may be considerably less than the foregoing, for castings which are press-straightened. In turning or boring diameters larger than 5 in., it is well to allow $^{1}/_{4}$ to $^{3}/_{8}$ in. on the diameter. If locating points are a considerable distance from the machined surface, additional allowance should be made.

How the castings are to be jigged or chucked is of importance when the amount of finish allowance is being established. The foundry should be given this information or locating points should be indicated on the drawing. Jigs should never be located from a point where a gate or feeder has been ground off; preferably they should be on the same side of the parting line—not at the parting line. They should be located where they will not be influenced by the shift of a core and should be as far apart as possible. Dimensions which have no finish allowance, and are to be held to close limits, should be considered as the proper place from which to start the development of tooling fixtures. If the producing foundry is given the proposed machining setup, it can recommend the most practical amount of finish on all machined surfaces. In any event, the drawings should show what surfaces will be machined, for this fact will govern the design of the pattern equipment.

When close tolerances are required on certain dimensions, the foundry should always be advised on these dimensions. By making slightly greater allowances on other less important dimensions, it may be possible to hold the important ones with great accuracy. If the quantity involved warrants the production of dies, the close tolerance may be even further reduced. To make certain that all drawing changes are incorporated, the "change designation letter," in addition to its customary tabular listing, should be marked at the edge of the print in line with the affected section, at every point shown.

SPECIFICATIONS

Standard Malleable Iron. Malleable-iron castings are customarily produced to ASTM Specification A 47 which provides for the two grades listed in Table 2.

TABLE 2 ASTM SPECIFICATIONS FOR MALLEABLE-IRON CASTINGS

	Tensile strength, minimum, psi	Yield point, minimum, psi	Elongation in 2 in., minimum, per cent
Grade 32510...	50000	32500	10
Grade 35018...	53000	35000	18

Military specifications closely approximate ASTM requirements. In neither case are chemical requirements specified. This is because in malleable iron certain elements may be substantially varied in amounts as long as the proper relationship is maintained between them. The user is of course interested in mechanical values which will indicate the performance of the part, so these values are the basis for specification.

Pearlitic Malleable Iron. Modifications of normal malleable iron, known as pearlitic malleables, are produced for use where wearing properties accompanied by a reasonable amount of toughness are required.[3] In these castings part of the carbon is in the combined form. Briefly, the ultimate strength varies from between about 60,000 to 90,000 psi, the elongation in the former averaging around 12 per cent and in the latter not more than 3 per cent. The type of material to be specified within the ranges depends upon the use to which the material is to be applied.

In general, pearlitic malleable has a higher average yield point and ultimate strength and lower elongation than normal malleable iron. It machines less readily and has a higher indentation hardness. When compared with drop forgings and steel bar stock of identical Brinell hardness, pearlitic malleable may be machined in less time, with greater tool life, and at less cost. In comparison with forgings it also possesses the general advantages inherent in a cast part.

The American Society for Testing Materials specification for pearlitic malleable-iron castings, A 220, provides for five grades as given in Table 3.

TABLE 3 ASTM A220 SPECIFICATIONS FOR PEARLITIC MALLEABLE-IRON CASTINGS

Grade no.	Tensile strength, minimum, psi	Yield point, minimum, psi	Elongation in 2 in., minimum, per cent	Typpial Bhn range
43010	60000	43000	10	163–207
48005	70000	48000	5	179–228
53004	80000	53000	4	197–241
60003	80000	60000	3	197–241
70002	90000	70000	2	241–285

STATISTICAL QUALITY CONTROL

Statistical quality control has been applied to advantage in production malleable-iron foundries. Some foundries cover melting, sand-mixing, coremaking, molding, annealing, grinding, and straightening with this control. Melting materials are checked, slag color noted, chemical analysis, and fracture checks recorded. The grain distribution of incoming sand is checked, also its mixing for both molding and coremaking. Since many of the critical dimensions of a casting are made by the core, a statistical check of the core box is the most direct approach to their control. In molding, the pins and bushings on a pattern plate are checked—in one foundry, four times each day. The molding sand is checked for permeability, moisture, bond, and combustibles, every 15 min and the results plotted. Annealed test-bar results are checked while the iron, from the heat that they represent, is still in process. Following grinding and finishing, critical dimensions are checked. The customer-rejected castings of the foundry employing this procedure amounted to less than 0.75 per cent over a period of a year.

Illustrative of the type of control charts used is Fig. 4 covering a critical core dimension.[4] The dimension checked is a cored diameter which must be not less than 1.725 in. because an arbor must pass through this diameter in the first machining operation. The heavy lines indicate the upper and lower control limits. The average of five readings is known as $\bar{X}$ and is recorded on the upper part of the chart; the difference between the highest and lowest reading of the group of five is called the range R, and is plotted as a point on the lower part of the chart. In this case no action is required until the upper control line reaches the upper specification line. This would result from wearing of the core box so that it would then require repair or replacement.

Through statistical quality control it is found possible to reduce the number of gaging operations, otherwise required in inspection, and to reduce the amount of scrap in the customer's plant to a minimum. Steps required in the quality-control program are: (1) Collect the proper data, (2) relay the data to the proper authority for action, and (3) act promptly as a result of this information.

[3] "The ABC of Iron and Steel: Production of Malleable Castings," by James H. Lansing, The Penton Publishing Company, Cleveland, Ohio, 1950.

[4] "Quality Control in a Malleable Iron Foundry," by E. F. Price and O. K. Hunsaker, American Foundrymen's Society Preprint 52-32, 1952.

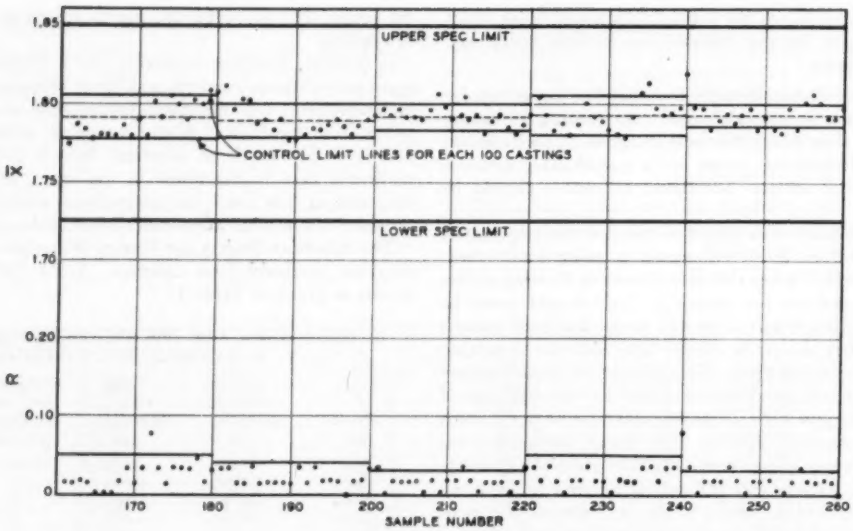

FIG. 4 QUALITY-CONTROL CHART
(For 1.9360 in./1.9375 in. finish diameter.)

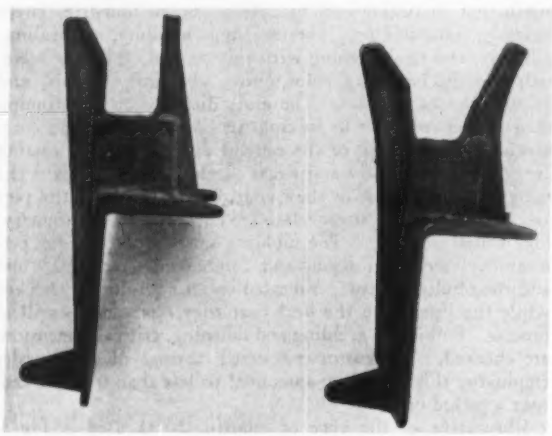

FIG. 5 LOW-TEMPERATURE IMPACT-TESTED MALLEABLE

TESTING, INCLUDING LOW TEMPERATURE

The conventional tensile testing of malleable iron is conducted on as-cast and annealed standard ASTM $^{1}/_{2}$-in-diam bars such as the unmachined bars shown in Fig. 2. Impact tests are at times conducted on wedge specimens 6 in. in length and 1 in. wide, tapering from $^{1}/_{2}$ in. in thickness at the large end to $^{1}/_{16}$ in. in thickness at the thin end. Subjected to repeated blows of a small drop hammer, something over 15 blows of 70 ft-lb each, generally are required to produce fracture.

Because of the possibility of equipment being exposed to extremely low-temperature operating conditions, military departments recently have been greatly interested in the behavior of various materials at low temperatures. To indicate such impact properties of a type of casting made by one malleable producer, low-temperature impact tests were recently conducted on sample castings. The casting, shown at the left in Fig. 5, was chilled to —70 F and tested by use of a small drop hammer by which it was struck a 60-ft-lb blow over an inverted V-block. After every two blows the casting temperature was again checked and maintained at —70 F. Following 12 blows, the mouth of the casting had opened up, shown at right in Fig. 5, and had bottomed on the V-block, but the casting had not fractured. Excellent low-temperature impact resistance was thus demonstrated and such use of the part was approved.

Low-Alloy Corrosion

A RECENT study by the National Bureau of Standards provides new information on the corrosion of certain low-alloy irons and steels in soils. Specimen plates of several of these materials (containing up to about 6 per cent of total alloying elements) together with reference specimens of plain steel, were buried at 15 test sites for periods up to 13 years.

Included in the Bureau's study were specimens of copper-molybdenum open-hearth irons, nickel-copper steels, and chromium steels with and without molybdenum. Sets of specimens were removed at regular intervals over the 13-year period, and after removal of corrosion products the weight losses and depths of the deepest pits were measured.

The steels containing 4 to 6 per cent of chromium generally lost only about half as much weight as did plain steel under the same conditions. However, the greater corrosion resistance of the alloy steels as measured by weight loss was not generally accompanied by a corresponding reduction in the maximum depth of pits. The least pitting was observed on specimens that contained molybdenum in addition to chromium.

The change in the rate of pitting with time was found to depend on the composition of the steel. Although the initial rate of pitting was greater for the alloy steels the depths of the deepest pits in the alloy steels were usually less than in the plain steel. This indicates that after the maximum period of exposure the alloying constituents induce the formation of corrosion products which tend to reduce the rate of pitting with time. The NBS study indicates that alloy steels may in some cases be appropriate choices for certain types of underground construction, such as piling, in which mechanical strength is of primary importance.

Room-Temperature COMPOUND PROCESS

By A. N. GRAY

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IN 1930, Western Electric Company entered for the first time into the manufacture of rubber-covered wire to partially fill Bell System requirements for communication wires. This was the result of having undertaken during the 1920's the development of continuous vulcanization, which had a considerable impact on the rubber-covered-wire industry. Perhaps the best measure of this impact is the fact that no less than 33 manufacturers throughout the world were licensed under Western's C. V. patents. Nearly all rubber-covered wire produced in the United States is now manufactured by C. V.

The plant[1] installed in Baltimore in 1930 included many innovations, besides continuous vulcanization, which were unusual in the rubber covered-wire business. Perhaps the most significant new feature was the introduction of highly accelerated rubber compounds. These compounds are capable of complete vulcanization in 15 sec at a temperature of 400 F. The equipment in the plant included twenty-six $3^1/_4$-in. extruding machines which were, at that time, most common in the industry. While this plant performed better than the pan-vulcanization method or any other method then in use, it soon became apparent that some improvement was in order in the characteristics of the extruding machines. Fifteen years of experience with this plant exposed numerous defects and instances where improvements could be made.

NEW METHODS NECESSARY

In 1945, a complete redesign of drop wire, making use of neoprene as an outer covering to replace asphalt-saturated cotton braid, presented the alternative of either expanding the plant mixing and extruding capacity according to the then existing machinery designs or completely redesigning the manufacturing equipment. In view of the many ideas of possible improvement which had accumulated in the course of the 15 years' experience and the promise of and belief in substantial savings to be realized, it was decided that complete redesign and modernization to incorporate these improvements were in order. Many of the proposed improvements could have been accomplished by desk engineering and designing, but the principal one obviously required some experimentation. The problem was the use of room-temperature compound to feed the extruding machines. This is not to be confused with the much publicized "cold rubber." It is the practice of feeding extruders with compounds which have been mixed in the usual way, immediately cooled, and held until needed at the extruders.

Before describing this work, perhaps it is in order to describe briefly the reasoning on which the procedure was predicated. Fig. 1 represents schematically a two-roll mill, an internal mixer, and a section of an extruder perpendicular to the axis of the screw. The mill is the earliest form of rubber mixer and has served the industry through more years than any other. Prior to internal mixers, it was used almost exclusively for mixing and subsequent warming up or conditioning compounds. Note the pair of in-running rolls usually at differential speeds and the mixing effect which is obtained by smashing and scrubbing the ingredients, including rubber, through the bite. This action repeated long enough results in thorough incorporation of the dry powders into the gum portion of the compound. With the advent of internal mixers, the mill was relegated in large part to conditioning of compounds with the internal mixer taking over almost exclusively as the mixing machine.

FIG. 1 SCHEMATIC DRAWINGS OF TWO-ROLL MILL, INTERNAL MIXER, AND SECTION OF AN EXTRUDER PERPENDICULAR TO AXIS OF SCREW

In the second representation is a schematic cross-section of an internal mixer. In this case, two pear-shaped rotors scrub and smash the ingredients against a stationary wall, but still the same scrubbing and smashing action as experienced in the mill. Both of these machines are obviously batch machines. It is practically inconceivable that they could be converted or modified to bring about continuous operation.

The third schematic representation is of an extruder with the screw in place, resulting again in the same smashing and scrubbing effect as shown in the mill and internal mixer.

DEVELOPING THE MODERN EXTRUDER

It was reasoned that if the proper kind of screw could be built, a machine capable of conditioning room-temperature compound simultaneously with the forcing of that compound onto the wire would result. The problem then was deciding what shape or manner of screw should be built. Fig. 2 shows a standard rubber-extruding screw. Use of the word "standard," however, may be open to question, but in 1930, and for a number of years thereafter, if anyone wanted to buy an extruding machine for rubber, this was the kind of screw obtainable. However, certain deficiencies were believed to exist in this screw. For example, note the deep thread and visualize the large cross section of the spiral of material when this screw is full. It was reasoned that this screw functioned to advance material by virtue of the angle of the pitch and the frictional resistance of the compound against the inner wall of the surrounding barrel. This was confirmed by feeding into an extruder successively several different colors of compound and observing the "snake." This showed laminar and indicated

[1] "Manufacture of Rubber-Covered Wires for Telephone Installations," by S. E. Brillhart, MECHANICAL ENGINEERING, vol. 54, 1932, p. 405.

Contributed by the Rubber and Plastics Division and presented at the Annual Meeting, New York, N. Y., November 30–December 5, 1952, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Slightly condensed.

FIG. 2 STANDARD RUBBER-EXTRUDING SCREW

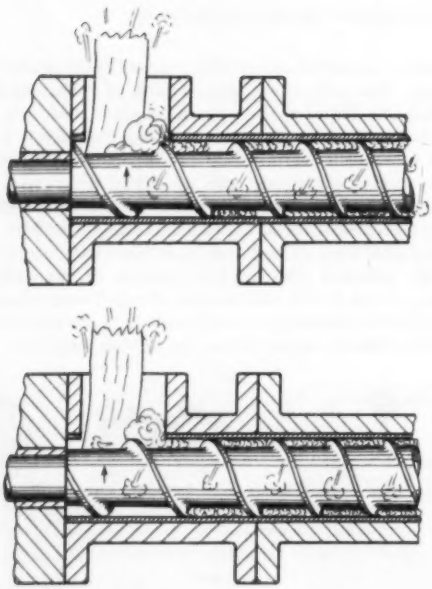

FIG. 3 CUTAWAY VIEW SHOWING OPERATION OF ROTATING SCREW

that the travel of the plasticized material through the screw was at differential speeds, the high speed being at the geometric center of the cross section of the flight.

Fig. 3 shows a schematic representation of the origin of the majority of the push which is applied by a rotating screw. As the screw rotates, it partially empties the first increment of the flight and then from the feed in the hopper takes a considerable bite. This, it was believed, gave an impulse to the material throughout the screw reaching to the extrusion die. Now the ideal condition for extrusion of a uniform covering on a wire is to have the plastic or elastomer emerge from the die at a uniform rate of speed equal to that of the wire speed. However, if, with each rotation of the screw which normally would be one per second, there is an impulse, then obviously the material will emerge from the die at a greater speed when the impulse strikes, diminishing until the next impulse. It was concluded on the basis of this kind of analysis that this type of screw was primarily a conveyer and only secondarily a conditioner of the material being handled.

Another consideration is illustrated in Fig. 4. In the hot-compound process, the compound is taken from the conditioning mill at approximately 200 F, put up in convenient packages, transported from the conditioning mill to the extruder, and a strip started into the machine. These packages were approximately 50 lb and required about 15 min or more, depending on the product, to be consumed. In the course of this consumption, the material naturally gave off heat to all of its environs, and at the end was usually down to 120 F, or less. The diagram on the chart shows areas which are proportional to the variation in plasticity during the time of consumption of a single such package. Obviously, it was not practical to have uniformity of this condition because it would be too laborious to co-ordinate a conditioning mill with an extruder so that the material stayed within this range of temperature.

In actual practice, one conditioning mill fed approximately seven extruders, and always an entire batch of nine packages had to be in transit to the extruders while the extruders were nearing the exhaustion of the previous batch. Therefore, a basic problem was the variation in temperature of the feed to the extruders which exaggerated the impulse effect referred to before. The problem of co-ordination was a constant one. With discontinuance of action of one or more extruders for various reasons, the liaison between the conditioning-mill operator and the extruder operator frequently failed and sometimes resulted in decided unbalance. This meant too long a delay after conditioning and before using and the loss of heat to the point where smooth extrusion was not possible. Frequently attempts were made to return this chilled compound to the conditioning mill for rewarming, which would be practical with ordinary acceleration. However, with ultra acceleration, this frequently resulted in prevulcanization and the loss of the material.

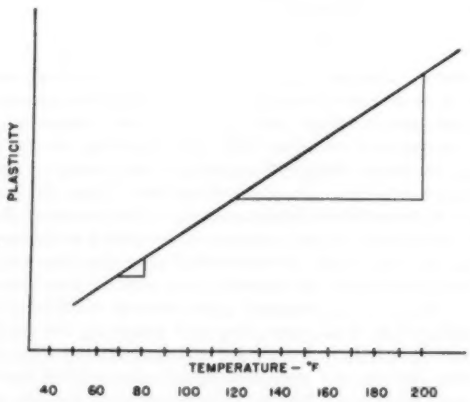

FIG. 4 VARIATION OF PLASTICITY WITH TEMPERATURE

The areas in Fig. 4 represent the variation of plasticity that can be expected in room-temperature compound from minimum to maximum room temperature as compared with the variation in compound from 200 F to 120 F.

On the basis of these partial conclusions, it was decided that a screw to perform the action desired needed to be considerably longer and to have a flight which decreased in cross-sectional area as the material advanced toward the discharge end. It was recognized that the work performed upon the compound by the screw depended on the rotation of the screw within the stationary barrel and that as the material gained heat from the

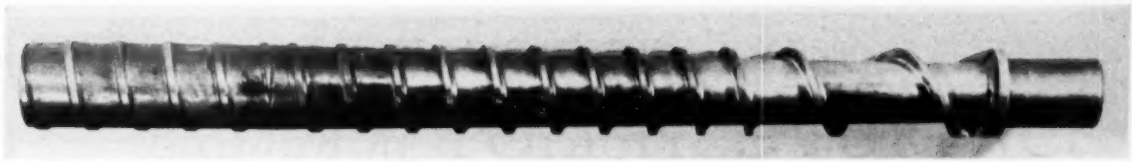

FIG. 5 EXTRUDING SCREW WITH TAPERED ROOT

FIG. 6 SECTIONS THROUGH TWO PIECES OF RUBBER-INSULATED WIRE
(Top view shows probable structure of an insulated wire made by old process. Bottom view shows what comes out of an extruder with a strainer mounted in head.)

frictional resistance, it responded less readily to work. Also, the material must be confined gradually to a smaller and smaller area. To accomplish this, a screw with a tapered root, having the deepest section of the flight at the feed hopper and tapering gradually to a shallow screw depth at the discharge, was constructed. The final result is illustrated in Fig. 5.

SOLUTION OF "ELECTRICAL BREAKDOWNS"

It had been hoped from the beginning to interpose a strainer screen between the discharge end of the screw and the extrusion-tool head. Up to that time, this had not been possible with the standard screw, except in a limited number of especially prepared and broken down compounds. It was found that as this final design was approached such a screw was capable of so conditioning the material that it could be easily forced through a fine-mesh screen without prevulcanization and thus another plaguing difficulty was solved. That difficulty is common to the industry and is known as "electrical breakdowns."

Fig. 6 illustrates this point and represents schematically two pieces of rubber-insulated wire. The top one shows the probable structure of an insulated wire made by the old process. The compound was exposed to recontamination through conveying, acceleration, reconveying, and, of course, during the time of feeding into the extruder, all after the straining operation. In the old plant, good operation was represented by 5 to 10 electrical faults per 100,000 ft. However, good operation was not always experienced and frequently the level of faults mounted to a point where extensive investigation and corrective measures had to be taken.

The bottom schematic in Fig. 6 shows what comes out of an extruder with a strainer mounted in the head. The size of the particles of incorporated agglomerates is controllable to any degree desired simply by the adoption of a finer and finer screen. This feature was not exploited any further than to use a 60-mesh screen, which reduced the incidence or electrical faults from an uncertain 5 to 10 per 100,000 ft to 1 per 300,000 ft. The implications of this are believed to be enormous. For certain specialties such as rubber-insulated submarine cable, here is available a technique for manufacturing any desired degree of purity or cleanliness of insulation to insure against failures caused by incipient faults, such as inclusions which do not break down in the normal inspection breakdown test.

To this new type of screw, these qualities can be attributed: The ability to receive a strip of compound at room temperature; to condition it uniformly and steadily so that it will pass freely through a screen interposed at the discharge end; to damp out to a large degree the impulses previously cited through the constantly decreasing cross-sectional area of the flight; and to impart breakdown to the material at a point close to its point of use, which is the extrusion die.

ADVANTAGES OF NEW TYPE OF SCREW

Following are the demonstrated advantages:

1 *Size Control.* Cost of rubber-covered wire, at least in the author's plant, consists of approximately 60 to 65 per cent material and 30 to 35 per cent labor and overhead. The major portion of the 30 to 35 per cent is overhead. Obviously then, the place to look for savings is in material. Ruling specifications boil down to wall thickness of insulation. Therefore, almost any amount of effort to control the manufacturing process so as to maintain uniformity of wall thickness is in order, and experience with the new plant has been that the size of insulated wire can be controlled to ±0.0005 in. Therefore, safe operation can be very close to minimum size without fear of degrading the quality of product.

2 *Scrap Reduction.* In the old plant approximately 5 per cent or more shrinkage in compound was experienced. With the new process it is less than $^1/_2$ of 1 per cent.

3 *Cleaner Insulation Reducing Electrical Breakdowns.* As mentioned previously, breakdowns have been reduced from a level of 5 to 10 or more per 100,000 ft to 1 per 300,000 ft, which is practically negligible.

4 *Transmitting Compound.* The opportunity to transmit the compound in a continuous belt to the extruder, which would be an unreasonably burdensome task, if at all possible, with hot compound.

APPLYING SYSTEM TO NEOPRENE

The same reasoning was applied to the jacketing material—neoprene. It was reasoned that it would respond to the same sort of treatment. People in the industry, particularly suppliers' representatives pointed out that no one succeeds in straining neoprene. Of course, such a generalization is open to challenge and it is recognized that certain specially formulated and specially conditioned neoprene compounds may be strained. These remarks are meant to cover only the usual wire- and cable-jacketing materials in which one always strives for the maximum mechanical properties by reinforcement with carbon-black. With the modification of the screw, Fig. 7, not only was it possible to strain all the jacketing materials immediately prior to extrusion upon the core, but also a large part of the necessary breakdown of the compound was accomplished.

In the case of neoprene, the compound is mixed in the internal

FIG. 7 MODIFIED EXTRUDING SCREW

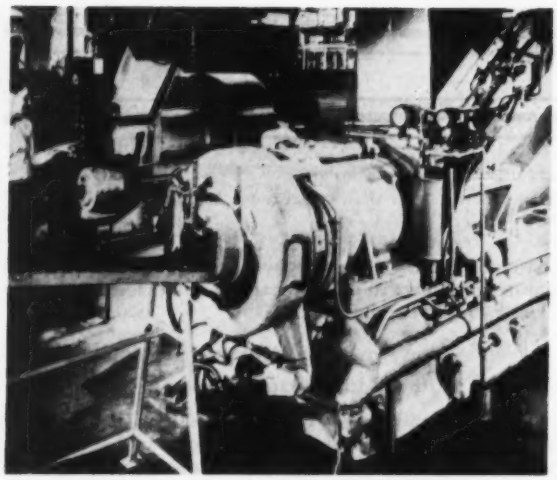

FIG. 8 TWELVE-INCH EXTRUDER WHICH RECEIVES BATCH OF NEOPRENE COMPOUND EVERY 10 MIN AND CONTINUOUSLY EXTRUDES STRIP OF COMPOUND

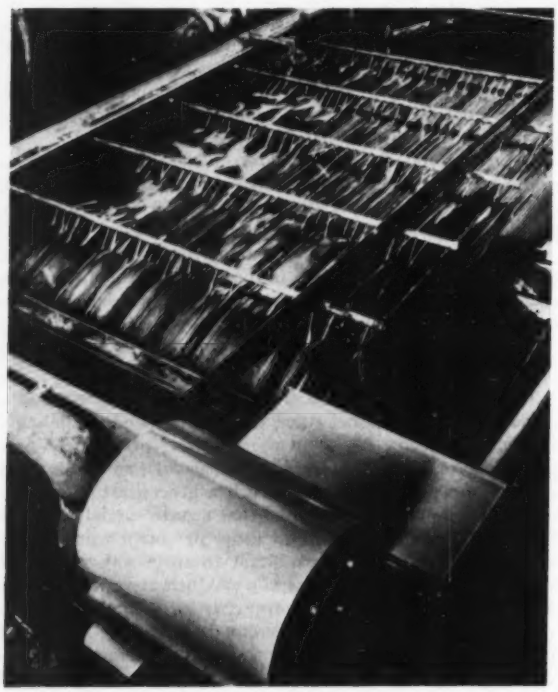

FIG. 9 COOLER WHERE CONTINUOUS EXTRUDED STRIP IS COOLED TO ROOM TEMPERATURE IN A FEW MINUTES

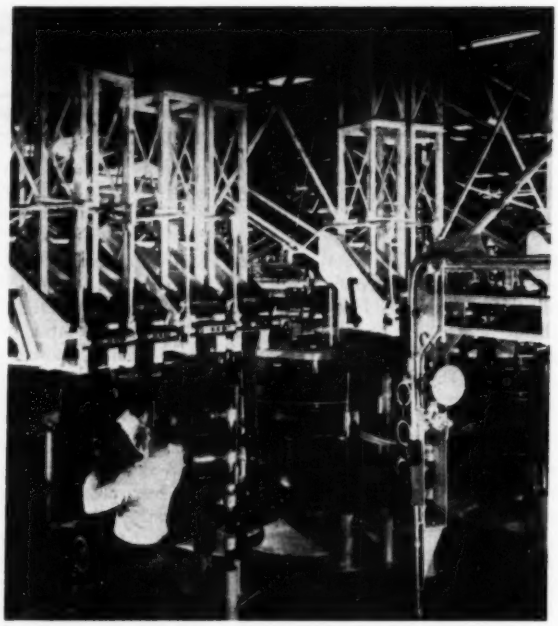

FIG. 10 INTERMEDIATE STORAGE WHERE COOLED EXTRUDED STRIP IS TAKEN UP TO BE STARTED ON FEEDING CONVEYER

mixer on a 10-min cycle and extruded in strip form continuously, arranged so that the extruder takes 10 min to empty, just in time to receive the new batch. Therefore, it becomes a continuous operation at the large extruder immediately under the mixer. This material is fed continuously through water for cooling, blown dry, taken up on intermediate supply stands, and conveyed to the wire insulator. To all intents and purposes this is a continuous mechanically handled operation from the mixing chamber to the coiling arrangement of the jacketed wire mounted at the end of the jacketing machines. The peculiar spirally ribbed tip on this screw was found necessary to impart the breakdown which was imparted previously by the warm-up operation as performed in the old plant.

Figs. 8, 9, and 10 are some selected views which give some idea of the new manufacturing facilities.

Most of the considerations outlined herein apply to the application of plastics. Many of the same principles already are applied to thermoplastic extrusion.

CONCLUSION

It is pointed out that this work is only a beginning in making use of extruders to condition as well as extrude rubber compounds. These improvements should be even more important to manufacturers of miscellaneous wire in smaller quantities than they are to Western. Furthermore, they should find application in all manufacture which involves extrusion of rubber or plastics.

An INTERFEROMETER *for Examining* POLISHED SURFACES

By RONALD E. SUGG

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CONVENTIONAL stylus-type instruments are unsuited to the examination of such surfaces as polished chromium plate and materials lapped or honed to a high finish. The stylus is incapable of contouring the small irregularities which may be only 1 or 2 microinches in depth. Furthermore, in most cases, the burnish mark left by the tracer is undesirable.

Tolansky[1] and others have developed multiple-beam interferometric techniques to a high degree and have employed these techniques in problems where extremely precise measurement of depth is important. Thin-film dimensions, cleavage characteristics of diamond and mica, and surface deformation from localized stresses represent a few of the phenomena which have yielded to the interferometric approach.

The use of multiple-beam interferometry has been restricted to laboratory research because of the necessity of using fragile silver films in the process and because of the specialized techniques involved. A multiple-beam interferometer which overcomes these limitations will be described. It is portable and suitable for use wherever the examination of fine surface detail is required. However, before discussing this instrument, a résumé of the principles involved is in order.

FIG. 1 INTERFERENCE FRINGES OBSERVED BETWEEN AN OPTICAL FLAT AND A SURFACE BEING EXAMINED FOR WAVINESS

MULTIPLE-BEAM INTERFERENCE PHENOMENON

The practical application of interferometry is simple and is probably best known in the use of optical flats, Fig. 1, for determining the waviness of lapped metal surfaces and optical parts. The optical flat is placed on the surface of the piece to be examined, and a series of interference fringes (or light and dark bands) which follows the contour of the surface, may be observed when viewed in monochromatic light. These fringes result from interference between light beams reflected from the two surfaces in nominal contact and occur at wedge thicknesses t given by the following formula $n\lambda = 2\mu t \cos \phi$, where n is the order of interference, λ the wave length of the monochromatic light, μ the refractive index of the material of the wedge, and ϕ the angle of incidence of the light. This expression reduces to $t = n\lambda/2$ for normally incident light with air as the wedge material. The spacing between fringes, no matter what it may be, reveals a constant half-wave-length difference in wedge thickness, and a method of measurement sensitive to a few millionths of an inch is offered. Since these interference fringes follow the contour of the surface, it is a natural conclusion that fine surface detail might be revealed and measured through magnification with a microscope. However, this is true only to a limited extent because the intensity distribution in the fringes, Fig. 2, follows a $\cos^2$ curve, resulting in light and dark bands of approximately equal width with inherently low ability to resolve detail.

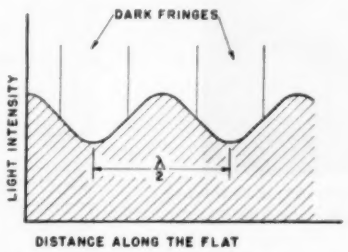

FIG. 2 LIGHT-INTENSITY DISTRIBUTION IN TWO-BEAM INTERFERENCE FRINGES

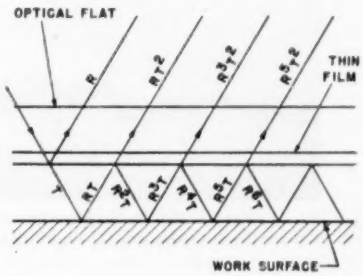

FIG. 3 REFLECTIONS WHICH OCCUR IN MULTIPLE-BEAM INTERFEROMETRY

Multiple-beam interferometry permits the width of the dark band to be reduced to relative hairline proportions, which does reveal fine detail. The manner in which this is accomplished involves coating the surface of the optical flat with a nonabsorbing film which reflects a large portion of the light and allows a smaller portion to pass through to the surface of the examined piece. If this film has transmission T and reflection R, a series of reflections occur, according to Fig. 3, with decreasing intensity $RT^2(1 + R^2 + R^4 + \ldots)$. Each beam has a phase lag

$$\delta = \frac{2\pi}{\lambda} 2\mu t \cos \phi$$

and Airy's formula[1] for the intensity at any point in the fringe system is

$$I = \frac{4R \sin^2 {}^1/_2\delta}{1 - 2R \cos \delta + R^2}$$

The resulting intensity distribution is shown approximately in Fig. 4 for $R = 0.90$ with no absorption. The net effect is

[1] "Multiple-Beam Interferometry," by S. Tolansky, Clarendon Press, Oxford, 1948.

Contributed by the Production Engineering Division and presented at the Spring Meeting, Columbus, Ohio, April 28-30, 1953, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

the sharpening of the fringe minima with a resultant increase in resolving power.[2]

Much has been written about these semireflecting films and the vacuum techniques used in producing them, but most workers have found that silver is the material best-suited to the requirements of multiple-beam interferometry.[3]

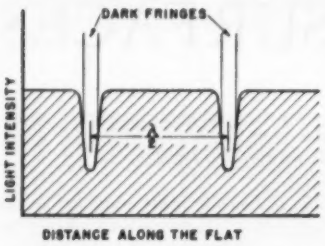

FIG. 4 LIGHT-INTENSITY DISTRIBUTION IN MULTIPLE-BEAM INTERFEROMETRY ($R \approx 90$ PER CENT)

While high vacua of the order of 10^{-6} mm Hg and extreme cleanliness of the optical surfaces on which the film deposition is to occur are important where depth resolution of a few Angstroms is necessary, most applications permit films of a less critical nature. This fact is of importance since many laboratories do not have vacuum equipment capable of achieving 10^{-6} mm, and also the time element in producing the coatings is a factor to be considered. Films sufficiently good for metal-surface examination have been produced in less than an hour with vacua in the 10^{-4} mm range.

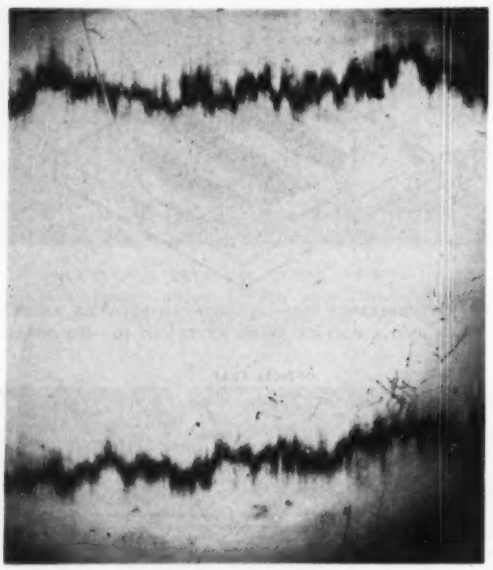

FIG. 5 INTERFEROGRAM OF A RHODIUM MIRROR SURFACE SHOWING POLISHING SCRATCHES 0.1 TO 1.0 MICROINCH DEEP

Extremely low absorption is more vital to the production of high-resolution fringes than is the reflection-transmission ratio, and fortunately, its evaluation for practical purposes may be made quickly and simply by viewing a small strong light source through two films inclined at a slight angle to each other.[4] Fifty to 100 reflections of the light source may be counted with good films, while even a greater number have been obtained with the best. It must be remembered that the number of these reflections (which is ultimately dependent upon absorption) determines the resolution of the interference fringes. Fig. 5, an interferogram of a rhodium mirror surface, was obtained with a film yielding around 60 reflections. The resolution of these fringes is around 25 Angstroms, which means that depth measurement may be made with this order of precision. This high resolution permits spreading the fringes to secure tremendous vertical magnification of the profile. The fringes represent constant elevation differences of 10.75 microinches when the monochromatic green light of a mercury-vapor source is used, and it is apparent that the vertical-profile magnification is around 300,000 when the distance between fringes is 3 in. Horizontal magnification, limited by the microscope, is low, so that a relatively large surface area may be observed.

MULTIPLE-BEAM INTERFEROMETER

Because of the fragile nature of evaporated silver films, great care is necessary in their use. Often, they may be used only once or twice and then must be discarded because of scratches. Tolansky[4] has mentioned the possibility of using nonmetallic multilayer films instead of silver. The dichroic mirrors produced by the Liberty Mirror Division of Libby-Owens-Ford Glass Company are of this type. They possess the property of selective transmission so that in white light they appear one color in reflection and another in transmission—hence the term dichroic. The mirror which is designated as No. 901 has a reflectivity exceeding 90 per cent and yields over 60 clearly visible reflections with the resultant high-resolution fringes shown in Fig. 6.

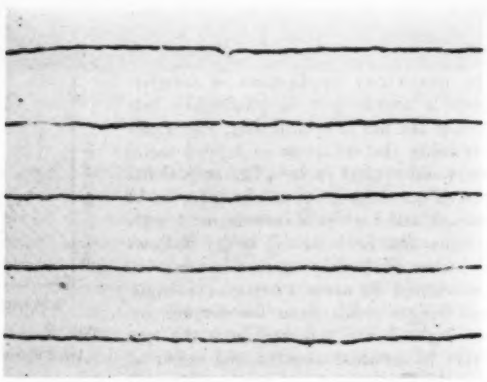

FIG. 6 SURFACE PROFILES OF PLATE GLASS OBTAINED WITH HIGH-REFLECTIVITY DICHROIC COATING AS INTERFERENCE FILM

It is believed that this work represents the first use of dichroic coatings for multiple-beam interferometry, and it should be mentioned that the optimum reflectivity for the examination of steel and chromium surfaces is around 65 per cent.

A significant property of the coatings is their durability; they are not impaired by oxidation and are abrasion-resistant. This fact makes multiple-beam interferometry practical as a shop tool. The optical system of a self-contained, portable multiple-beam interferometer is shown schematically in Fig. 7. Collimated monochromatic light from a small low-pressure mercury tube is directed at approximately normal incidence onto the dichroic film of the optical flat where approximately 65 per cent of it is reflected and the rest is transmitted to the surface under examination. Multiple reflections occur between

[2] "Multiple Beam Interferometry; Intensity Distribution in Reflected System," by J. Holden, Proceedings of the Physical Society, vol. 62-B, 1949, pp. 27, 407–417.

[3] "Measurement of Thickness of Thin Films by Multiple-Beam Interferometry," by O. S. Heavens, Proceedings of the Physical Society, vol. 64-B, May 1, 1951, pp. 419–425.

[4] "Multiple Beam Interferometry and the Influence of Vacuum Technique," by S. Tolansky, *Vacuum*, vol. 1, April, 1951, pp. 75–91.

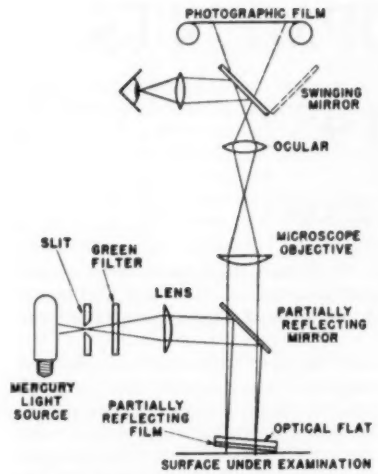

FIG. 7 LIGHT PATH IN MULTIPLE-BEAM INTERFEROMETER

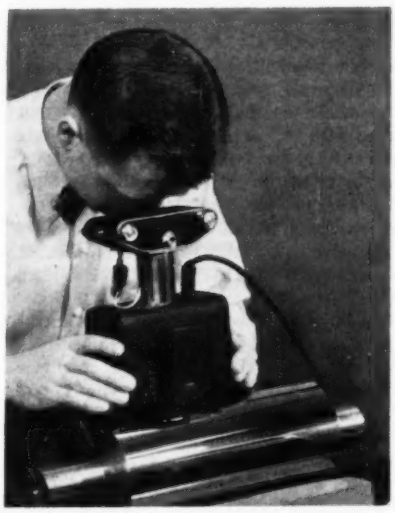

FIG. 8 MULTIPLE-BEAM INTERFEROMETER IN USE ON A SMALL ROLL

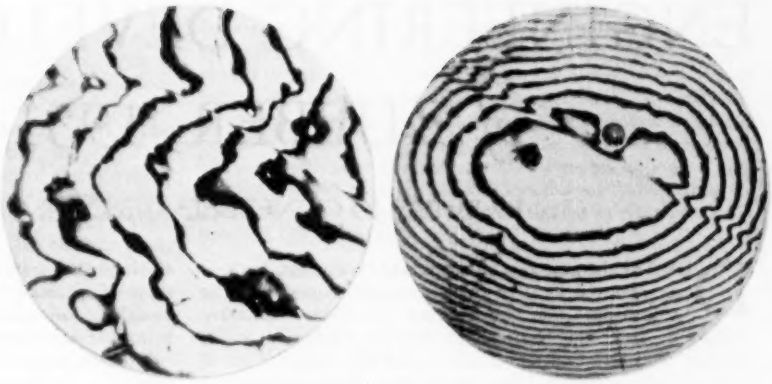

FIG. 9 PROFILES OF CHROMIUM PLATE
(Object on right is spherical and much smoother than flat piece at left.)

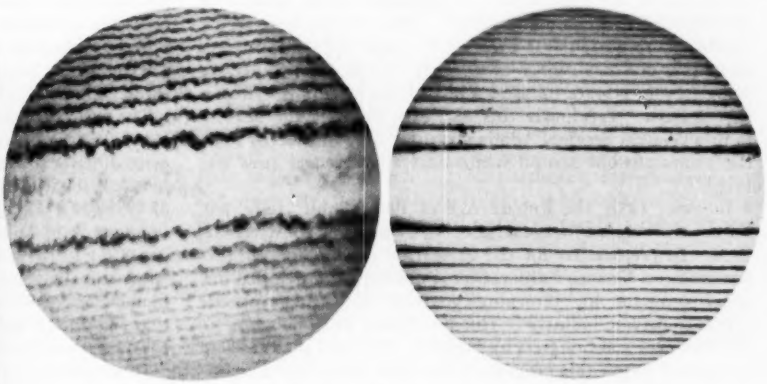

FIG. 10 SURFACE PROFILES OF HIGHLY FINISHED ROLLS
(Cast-iron roll with orange peel at left, and ultrafinished steel roll at right.)

the two surfaces in nominal contact until the half-wave-length-path difference necessary to interference is reached.

This instrument combines into one unit all of the elements necessary to surface examination by multiple-beam interferometry, Fig. 8. It is designed to be used on any size piece and requires no focusing or other adjustment beyond control of the wedge angle for fringe orientation. In use, it is placed on the surface to be examined, which may be flat or curved. Surface defects will be observed, and the angle between the interference flat and the workpiece is adjusted until the fringes are spaced properly. The narrow fringes, or surface profiles, are viewed through the camera's reflex finder and may be photographed. The adjustable supports are used to orient the fringes across scratches and to control the distance between fringes through control of the angle between the flat and the examined surface. A lever system is used to raise and lock the optical parts during positioning in order to prevent damage to the interference film and to the surface of the piece under examination.

Figs. 9 and 10 show some of the results obtained with the multiple-beam interferometer. The two chrome surfaces in Fig. 9 appear much the same to the naked eye; however, the multiple-beam interferometer reveals that their surface characteristics are vastly different. Their physical properties, therefore, would not be the same. This illustrates the danger of dependence upon visual observation as a means of inspection.

APPLICATIONS

To date, the instrument has found the widest application in the examination of rolls used in the production of aluminum foil, photographic-film base, and other web materials. Fig. 10 shows two rolls used for such purposes. It is obvious that the smoother surface would produce a better product. The irregularities evident in the cast-iron roll are caused by a slight "orange peel" only about 4 microinches in depth. The ultrafinished roll has a much better finish. It is free of orange peel, and the irregularities present are less than 1 microinch in depth.

In summary, the multiple-beam interferometer provides the most sensitive means of measuring fine surface detail of brightly reflecting surfaces. Its application to matte surfaces and ordinary ground surfaces should not be considered. The instrument is portable and easy to use and, therefore, recommends itself for field and shop use.

ENGINEERING DEVELOPMENTS *of* RUBBER, 1951-1952

By BETTY JO CLINEBELL[1] AND LEORA E. STRAKA[2]

DURING the past year the National Production Authority removed most of the government controls on the acquisition and consumption of rubber. Effective January 1, 1952, the National Production Authority, in its revision of Rubber Order M-2, authorized the unlimited use of synthetic rubber, but the limits on the amount of natural rubber used in products were kept in effect (1).[3] In April, 1952, in another revision of Rubber Order M-2, the National Production Authority removed all but a few minor restrictions on the use of natural rubber. This order also made provisions to prevent a decrease in the consumption of synthetic rubber because of uncontrolled natural-rubber usage. Also, the Reconstruction Finance Corporation was directed to build up a government stock pile of GR-S rubber of at least 75,000 tons. Effective July 1, 1952, private industry resumed the buying of natural-rubber latex. Previously this had been done by the government's General Services Administration (2). In March, 1952, the 13-months-old ban on white-sidewall passenger tires was lifted (3).

In June, 1952, the Rubber Act of 1948 (Public Law 469, Eightieth Congress) was extended for 21 months, to March 31, 1954. In preparation for the expiration of this act, the Reconstruction Finance Corporation is developing a detailed disposal program for returning government-owned synthetic plants to private industry. This program is to be presented to the President and Congress by March 1, 1953, and the President is required to put this program in the form of legislative recommendations to Congress by April 15, 1953 (4). It has been announced that an engineering appraisal of government-owned synthetic plants will be undertaken as part of the disposal program (5). According to the President's Materials Policy Commission Report on Rubber, the declared United States Government policy is "that the security interests of the United States can and will best be served by the development within the United States of a free competitive synthetic-rubber industry" (6).

Production of synthetic rubber is at its highest in history—843,000 tons per year. All of the twenty-eight government-owned synthetic-rubber plants have been reactivated. One third of the synthetic rubber now produced is cold rubber. It was predicted that by the end of 1952, 75 per cent of all synthetic rubber produced would be cold rubber (7). Restrictions on the purchase of government-produced cold synthetic rubber were removed in an Amendment to Order M-2, dated August 29, 1952 (8).

It has been estimated that cold rubber has saved 700,000,000 in increased tire mileage in the 5 years it has been available—more than the cost of building the entire United States synthetic-plant system (9). In January, 1952, government-owned synthetic plants were producing between 3100 and 3600 tons a month of oil-extended rubber, and higher production was being discussed (10).

The consumption of GR-S latex increased in 1951, as compared with a drop in the consumption of natural-rubber latex (11, 12).

It has been predicted that by 1955 the demand for new rubber may be 150,000 tons in excess of the world's present total capacity, and that by 1960 the demand will be 1,500,000 tons in excess of the present potential capacity (13). According to the President's Materials Policy Commission Report, the consumption of rubber may double by 1975, and since natural-rubber production is not expected to increase by more than 35 per cent, this increased consumption necessarily will be synthetic rubber (14).

The price of natural rubber had fallen from 66 cents per lb in June, 1951 (15), to 39 cents per lb in May, 1952 (16). The price of natural rubber for the first half of 1952 averaged 37.8 cents per lb, as compared with 64.7 cents per lb for the first half of 1951 (17). The price of synthetic rubber ranged from 24.5 cents per lb in August, 1951 (18), to 26 cents per lb in September, 1951 (19), and to 23 cents per lb in March, 1952 (20). Although the price of petroleum butadiene was raised from 13 cents per lb to 18 cents per lb on September 1, 1952, it is expected that the price of GR-S will remain at 23 cents per lb for at least the next several months (21).

In an effort to stimulate crude-rubber production in Central and South America, over a period of years the Government has helped to establish rubber-tree plantations in fourteen countries extending from Mexico through Brazil. There are now 35,000 acres of tree rubber under cultivation in Central and South America (22). A supply of rubber in the Western Hemisphere would lessen the peril of being cut off from our source of supply in the Far East, and also, a rubber-growing program should bring about an economic improvement in the Western Hemisphere. As proof that the idea is practical, rubber has been grown successfully and economically in Costa Rica for the past 15 years (23). Rubber-growing in Africa, which has been carried on since the beginning of the century, is steadily increasing, although the rubber produced is only a small percentage of the total world production (24).

COLD RUBBER

The advantages of cold synthetic rubber polymerized at 5 C over standard GR-S polymerized at 50 C are well established. However, continuous studies in this field have shown that polymerizations carried out at a series of temperatures, ranging from —18 C to 50 C, give products which vary as a function of the temperature and molecular weight. For instance, it has been shown that there is an improvement in stress strain and resilience as the polymerization temperature is reduced from 50 C to 5 C; this improvement was much greater than that resulting from further reduction to —18 C (25). A new cooling apparatus has been developed which cuts the reaction time for cold rubber to 11 hr, and increases capacity by 20 per cent (26).

[1] Librarian, Rubber Division Library, University of Akron, Akron, Ohio.

[2] Research Librarian, Goodyear Tire and Rubber Company, Akron, Ohio.

[3] Numbers in parentheses refer to the Bibliography at the end of the paper.

Contributed by the Rubber and Plastics Division and presented at the Annual Meeting, New York, N. Y., November 30-December 5, 1952, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

OIL-EXTENDED RUBBER

Oil-extended synthetic rubber, an outstanding development of the past year, is made by adding substantial proportions of rubber-processing oil to the synthetic latex before coagulation. This method provides a sizable extension of the rubber hydrocarbon with a more available, less expensive material. The commercial production of butadiene-styrene copolymer-oil mixtures has been established. Vulcanizates of the tire-tread type have as high tensile strength and are as resistant to heating in air as are corresponding GR-S vulcanizates, and the former show higher extensibility, better resistance to flex-cracking, and lower strain modulus than do the latter. Tires made of this butadiene-styrene copolymer-oil mixture have given better service than tires made either of standard GR-S or of cold GR-S.

The abrasion resistance of the new oil-extended rubber is superior to both standard and cold GR-S and also natural rubber in passenger-car tires. Tread adhesion has not been affected seriously by migration of the oil to the carcass (27, 28, 29). Tire-tread tests have shown an increase of 21 per cent longer wear with the oil-extended rubber over standard or cold GR-S (30). Investigations have shown that oil present in unvulcanized rubber separates the molecules and prevents bonding into a completely vulcanized mass, while the same amount of oil diffused into vulcanized rubber has a much less degrading action (31).

An analysis of the hydrocarbon type of petroleum products used in rubber compounding has been developed which permits the writing of exact specifications for petroleum-product compounding ingredients (32, 33). There are two types of hydrocarbon molecules present in rubber-processing oils from petroleum: (*a*) aromatic hydrocarbons, and (*b*) naphthene hydrocarbons. Different oils vary widely in composition and properties. Experiments indicate that oils relatively high in aromatic content improve the processibility, tensile strength, and modulus of rubber, while oils low in aromatics but high in naphthenes improve the low-temperature properties, rebound, and color (34).

HYPALON

A new rubberlike elastomer, Hypalon, has been introduced to the rubber industry. The elastomer is made by treating polyethylene with chlorine and sulphur dioxide. The structure, and therefore the properties, of chlorosulphonated polythene elastomers can be varied by using different molecular-weight polythenes, and various percentages of sulphur and chlorine. The outstanding properties of Hypalon, as it is now offered commercially, are complete resistance to abrasion, heat, sunlight, and weather. Tests show that when other elastomers are blended with Hypalon, improved resistance to ozone results. Conventional rubber machinery can be used for compounding and processing Hypalon. There are two methods of curing chlorosulphonated polythene: (*a*) With a combination of metal oxides, sulphur-type accelerators, and organic acids, and (*b*) with certain organic compounds in combination with acid acceptors. Since carbon black is not required in Hypalon, applications of this rubberlike material are independent of color. Some of the expected uses are white sidewall tires, tire treads, wire and cable coverings, coatings, mechanical goods, and protective films (35, 36, 37, 38).

ALFIN POLYMERS

Further developments in the use of Alfin catalysts for the polymerization of butadiene have been made. Alfin catalysts are special combinations of sodium salts which cause rapid polymerization of butadiene to unusually high-molecular-weight polymers. Polymerization reactions of butadiene, styrene, and other monomers have been studied, using Alfin catalysts. It was found that hydrocarbon oils and carbon black could be incorporated during or immediately after the polymerization reactions, thus improving the processibility of the polymers. Until the use of this oil-extension principle, the use of Alfin-catalyzed rubber was prevented by its extreme toughness, which made processing very difficult. Tires made of Alfin polymers are expected to be superior to both GR-S and natural-rubber tires. The Alfin polymers have been produced successfully on a continuous pilot-plant scale at the Government Laboratories at Akron, Ohio, and they are being evaluated in tires and other products (39, 40, 41).

OTHER TYPES OF RUBBER

Neoprene Type WRT, a new synthetic rubber, has a much greater resistance to crystallization both before and after vulcanization than Type W, which it closely resembles. Also, Neoprene WRT has a high degree of resistance to compression set over a range of temperature of —40 C to 150 C (42). In contrast to the chlorine derivatives of butadiene, research on the introduction of fluorine into butadiene shows that there is no improvement in cold resistance or general physical properties of the resultant polymers (43). As a substitute for styrene, sometimes scarce or relatively costly, vinyl toluene can be combined with butadiene to give a new synthetic material comparable to the best of the synthetic rubbers (44).

Polybutadiene, as prepared by emulsion polymerization, is a rubbery material with a high degree of rebound, low tensile strength, and only 25 per cent elongation. When polybutadiene is baked at high temperatures, a rigid highly cross-linked resin is produced which is a heat-resistant, solvent-resistant, dimensionally stable material (45). Although rubber from the Hevea tree is the principal source of natural rubber for the United States, researches on the recovery of rubber from other sources, such as guayule, are not dormant (46, 47). Recently the United States Department of Agriculture reported that, according to special tests, truck casings made of 100 per cent guayule were equal to natural-rubber truck tires and better than those containing synthetic rubber (48).

CELLULAR RUBBER

Because of the steadily increasing interest in cold rubber, researches which have been conducted on foam rubber show that when it is made of cold GR-S high-solids latex rather than latex polymerized at 50 C, it has greater tensile strength, better elongation at break, higher modulus, improved rebound elasticity, and enhanced low-temperature properties (49). Further investigations in the field of foam rubber have shown that the sulfonyl hydrazide type of blowing agent has proved very satisfactory for rubber and plastics since it provides a fine uniform cell structure and involves no processing difficulties (50). Aging resistance to light of cellular rubbers made from latex has been found to be largely improved by the use of nickel dibutyldithiocarbamate (NBC) (51). The undesirable odor of synthetic-rubber latex, which is used chiefly in foam-rubber products, has been overcome by the elimination of styrene from the formula, resulting in a polybutadiene latex. However, since polybutadiene latex made by the conventional "hot" process was too weak for most purposes, a "cold" process was developed which gives an odorless polybutadiene latex with sufficient strength (52).

LATEX

Synthetic-rubber-latex developments include several new low-temperature latices, some of which are polymerized to 50 per cent solids and heat-concentrated to 60 per cent solids. Other new products developed include latices containing no permanent electrolyte and emulsified with volatile-base soaps, and latices

prepared with cationic emulsifiers for coating and impregnating applications (53). In a study of cast films from mixtures of natural- and synthetic-rubber latex, it was found that cold-rubber latices give better results than standard high-temperature latices in the blends. For example, cold-rubber latices imparted higher stress-strain values to blends with natural rubber than the hot-rubber latices but they do not approach natural-rubber latex in stress-strain properties (54).

An investigation of two types of Hevea-latex films, those vulcanized in the latex state, and films vulcanized after drying, showed that the films cast from vulcanized Hevea latex were much more permeable to water vapor, sorbed considerably less water, and had a greater negative temperature dependence of permeability than films vulcanized after drying (55). Further development of the use of rubber latex in cement compounds has proved their applicability as bonding mortars in the construction of acid-resisting brickwork. These rubber-latex-cement compounds have excellent adhesive properties, considerable bond strengths, and reasonable compression strengths (56).

Although butadiene-styrene latex paints have been accepted widely for interior use, similar formulations for use as exterior coatings until recently were unsatisfactory owing to lack of storage stability. Now latex paints using butadiene styrene as a binder and a pigment system, consisting of a 40-40-20 mixture of titanium dioxide, zinc oxide, and mica has been found to give good results on exterior exposure on cement-type or oil-primed metal surfaces (57).

RECLAIMED RUBBER

A newly developed continuous process for reclaiming scrap rubber has been found to cut time from 3 days to 1 hr (58). In a study of the effects of blending reclaim with natural rubber, GR-S, and Neoprene GN-A, blends of reclaim and Neoprene GN-A gave the best results, showing improved resistance to ozone, weathering, and cut growth, increased tensile strength, and slightly decreased heat build-up (59).

ADHESION

Materials which should find wide application in the chemical, electrical, and aircraft industries are obtained by bonding fluorocarbon plastics to metals and rubbers, by a new bonding process. The fluorocarbon plastics are mechanically stable over a wide temperature range, have high resistance to most corrosive agents, and have high dielectric strength (60). Investigations also have shown that Butyl rubber can be bonded satisfactorily to metal, using a cement based on a chlorinated rubber and a diisocyanate (61). It has been found that a high degree of flocculation of the carbon black in rubber to metal cements increases adhesion. This is ascribed to the surface activity of the carbon black (62).

For the purpose of adhering silicones to various other surfaces a new primer has been developed during the past year, whereby silicone rubber can be bonded to certain metals and plastics. Some metal surfaces have a distinctly detrimental effect on the curing of the silicone rubber at the junction face when bonding is attempted with the new technique, and this prevents adhesion, but the difficulty can be eliminated by the correct choice of silicone-rubber stock (63).

MECHANICAL GOODS

Nitrile-rubber gaskets virtually have replaced composition cork, neoprene cork, and other types of special rubber gaskets in electrical apparatus. A reference list of sixteen uses of nitrile-rubber gaskets in various electric assemblies has been compiled along with load-deflection curves for nitrile-rubber gaskets (64). Until recently it had not been considered possible to use the O-ring in a seal for a rotating shaft except at very low rates of motion. However, tests have shown that these seals will work at speeds as high as 4000 rpm and also at pressures as high as 1000 psi (65). GR-S has been found to give satisfactory service for pipe-joint rings, and it is believed that synthetic rubber is equal to or better than natural rubber for these rings (66).

A torsion spring of particular significance for the wheel suspensions of vehicles has been developed. It consists basically of rubber cylinders contained within the spaces between concentric outer and inner shells or sleeves of polygonal cross sections. The rubber rolls are assembled between the inner and outer tubes under slight radial compression and maintain the tubes in coaxial positions. No adhesive bond is present between the rubber parts and the tubes. Friction at the contact surfaces is the only resistance to slippage during deflection (67).

Natural-rubber and several types of synthetic-rubber single-compression mountings for machinery have been investigated with regard to the transmission of mechanical vibrations. The transmissibility of natural rubber was found to be lower than that of any of the synthetic rubbers, and was practically constant over a frequency range of 25 to 2000 cycles per sec (68). Various design factors and their influence on the final form of the spring have been discussed with respect to the development of a spring for the independent suspension of the nondriven wheels of road vehicles, such as trailers, and the like (69).

Air filters composed of electrostatic materials such as rubber hydrochloride, cyclized rubber, chlorinated rubber, polyethylene, polyisobutylene, or polystyrene are capable of collecting dust from the atmosphere when used in conventional forced-draft heating, ventilating, and air-conditioning systems. Such filters function by electrostatic attraction and precipitation and are therefore effective throughout their entire thickness. They are easily cleaned by washing with cold water and can be reused without deterioration of their electrostatic properties (70).

Blends of butadiene-acrylonitrile rubber and phenolics have proved that they provide improved impact strength, vibration fatigue, thermal shock resistance, good machinability, wear resistance, chemical resistance, and adequate electrical properties, and offer numerous possibilities for compression-molding (71).

Although the inflatable deicer has been used commercially for 17 years to protect aircraft from the hazards of ice formation on their wings, the fundamental principles of ice removal have never been discussed in detail. Such an analysis has been made within the past year, and it was found that the removal of ice from a deicer surface depends on the true adhesion of ice to rubber and on the stress concentration produced by the operation of the device (72).

TIRES

Several studies have been made on the tread wear of tires. One method, which is independent of mileage, is based on the hypothesis that the log-log graph of tread-depth loss versus mileage is linear (73). A study of factors such as the effects of vehicle, wheel position, day of test, climatic conditions, and length of storage, by statistical road tests, has led to the conclusion that geometric rather than arithmetic averages should be used in the evaluation of tread wear. Also, a study of two methods of tire-wear measurement, depth of tread grooves, and weight loss, showed that a tire loses weight at essentially the same rate, whereas the depth of tread grooves decreases at a declining rate, resulting in a bias in tread-wear ratings (74).

In another investigation of tread-wear measurement by the "weight" method and the "depth" method, it was concluded that the rate of wear changes with the age of the tire and climatic conditions. An evaluation of different rubbers and car-

bon blacks and an investigation of aging, seasonal effects, and wheel-position effects on tread wear were included in this study (75). The extent to which the effects of nonlinear vibration characteristics of tread stocks are dependent upon temperature, compounding variables, and type of vibration has been investigated (76).

Further developments have been made in the adhesion of tire cord to rubber. Solvent-extracted cottonseed meal has been found to compare favorably with casein for the bonding of tire cord to rubber (77). To obtain good adhesion between rubber and Terylene polyester fiber, polyisocyanate adhesives give satisfactory bonds whereas casein and resorcinol-formaldehyde adhesives give poor adhesion (78). Some aromatic diamines substantially increase the adherence of rayon cord to synthetic rubber (79). A practical, reasonably quick method for evaluating the resistance of the adhesive bond between tire cord and rubber stock to dynamic fatigue employs the Roller-Flex machine, on which the test cords, cured in rubber and under tension, are subjected to rapid cyclic flexure by being passed back and forth around small steel rollers (80).

In an investigation of the changes in mechanical properties of tire cords subjected to dynamic fatigue, flex life and ultimate elongation were found to be cumulative, regardless of whether the cords were fatigued continuously or were allowed to relax with or without static tension between periods of flexing. Calculated activation energies for fatigue failure were less than those for heat degradation (81).

A study of thermal degradation in cotton and rayon tire cords, before and during processing, and after vulcanization, showed that tire cords which had been vulcanized in rubber were not affected as severely by heat as the unprocessed, dipped, or calendered cords (82, 83).

An investigation of the properties of rubber vulcanizates and cord upon rapid deformation has shown that both the elasticity modulus and the dynamic viscosity are related to the rebound (84). Certain sodium-alkaryl sulphonates have been found to be the most effective conditioners for twisting cotton tire cord. Cords treated in this way show increased strength without loss in elongation if the elongation was not reduced too greatly by subsequent wet-stretching (85).

COMPOUNDING

In the compounding of rubber, the nature of the carbon black used, the amount, and the degree of dispersion in the rubber are all important factors in determining the physical properties of the resultant rubber compounds. It has been found that electrical resistivity of rubber vulcanizates is a simple and sensitive test for characterizing carbon blacks, and this test should prove to be useful for quality control of production and for specification purposes (86). Carbon-black dispersion has been studied by various methods, such as the audioradiographic technique with carbon 14, the electron-microscope method, and by an interrelation of photometric, rheological, and electrical measurements (87, 88, 89, 90). Also, the electron microscope has been employed to study carbon gel in rubber, and its role in the reinforcement of rubber (91).

Another reinforcing agent, lignin, has been found to impart a novel combination of properties when coprecipitated with natural, nitrile, neoprene, or GR-S rubbers. Good abrasion and tear resistance result, and the tensile strength is improved in certain cases. In GR-S, nitrile, and natural rubbers, high elongation and low modulus are combined with high tensile strength and high hardness (92).

By incorporating 20 per cent by volume of commercial mica or powdered aluminum in natural rubber, the permeability can be reduced to one third the value for an unloaded vulcanizate. Inner tubes made of these mixtures are being tested. It is hoped that these natural-rubber compounds will approach Butyl rubber in its impermeability to gases, while retaining the advantages of natural rubber over Butyl rubber (93).

TESTING

Nondestructive aging tests for rubber have been devised for correlating natural aging with accelerated aging and service life. These tests are based on the change of electrical resistivity or of the strain produced by a given stress at varying time intervals on the same specimen (94). In a comparison of the aging of rubber compounds under tropical conditions, it was found that samples aged under dry conditions in the tropics are more influenced by bright sunlight than by heat-aging. The use of a dark pigment reduces the depth of oxidation catalyzed by light (95). A new method for determining aging resistance, which is less time-consuming than the normal Geer test, involves the measurement of stress relaxation at constant elongation (96).

To study the mechanism of rubber abrasion, an apparatus has been devised which employs a gramophone needle to abrade the rubber, and the movements of the needle are recorded photographically on a magnified scale. The abrasion produced by the needle is supposed to be similar to the strain set up in the tread during wear on the road (97). The theory has been advanced that only by the application of an equation of the power-law type in wear tests can true values of abrasion tests be assessed from the point of view of service tests (98). Modifications of the Lambourn abrader and the National Bureau of Standards abrader have resulted in improved abrasion-resistance tests for GR-S vulcanizates (99, 100).

In an investigation of the permeability of rubber to organic liquids, it was found that polar liquids had the greatest permeability through the polar rubbers, while nonpolar liquids had the greatest permeability through nonpolar GR-S. Neoprene, which is weakly polar, had an intermediate position with all the liquids. Thiokol had the lowest permeability of the various rubbers. Permeability was found to increase logarithmically with temperature for each rubber-liquid combination (101).

A constant-stress method of testing elongation has been developed to measure precisely the elastic properties of rubber compounds which are too soft to test on the conventional stress-strain machines. This method has been particularly useful for characterizing unvulcanized polymers and for evaluating plasticizers in uncured compounds (102). An electrical extensometer has been designed to be used in the ASTM Method of Tension Testing of Vulcanized Rubber to record automatically the elongation of the reduced section of the specimen throughout the test without interfering with the test and its attendant manipulations (103).

It has been found that the tensile strengths of vulcanizates of butadiene-styrene rubber, and also the elongation at rupture, decrease sharply with rise of temperature in the interval from 10 C to 80 C. Further rise of temperature up to 140 C only slightly changes this property (104). The mechanical properties, such as strain in a compression test, of a vulcanizate of known composition can be predicted by an empirical method which takes into account the imposed static strain, the shape factor, and the dynamic stiffening. The results are plotted in a general form in such a manner that the data can be used in solving general problems (105). Experiments have shown that there is a definite relationship between strain measurements at 5 kg/cm^2 and modulus at 100 per cent elongation (106).

Recently developed methods for measuring the dynamic modulus and hysteresis of rubber compounds include a vector-subtraction method, and a method employing a photoelectric device. An instrument based on the torsion-pendulum prin-

ciple has also been designed to measure the dynamic shear modulus and mechanical damping of rubberlike materials (107, 108, 109). By the use of reduced variables, the temperature dependence and frequency dependence of dynamic mechanical properties of rubberlike materials can be interrelated without any arbitrary assumptions about the functional form of either. The use of the distribution function to predict various types of time-dependent mechanical behavior is illustrated (110). Useful approximate relations have been derived by investigation of the mathematical structure of the integrals relating the distribution of relaxation times to the observed properties and by examination of the behavior of certain particular relaxation-time distributions (111). An electrical analog for explaining elastomer behavior has shown that a creep for a model of GR-S tread stock obtained in a fraction of a second represents the creep observed in the actual stock in a period of 1000 hr (112). The mechanical behavior of cylindrical specimens of elastomers at very small torsions can be studied by means of a recently introduced apparatus (113).

The quality of a rubber is measured by the percentage of rubber hydrocarbon, and rubbers from different sources vary considerably in rubber-hydrocarbon content. A new procedure for the quantitative determination of the hydrocarbon requires only the measurement of the refractive index of a solution containing a known weight of rubber in a known weight of solvent (114).

A recently developed recording photoelectric interferometer simplifies the determination of transition temperatures in natural and synthetic rubbers and other high polymers. The instrument plots the varying length of a polymeric sample against temperature over the range —185 C to 185 C and then the transition temperatures are obtained as discontinuities in the curve (115).

The static safety of a rubber product can be measured by a method which employs an electrostatic generator or induction coil to impose voltage in order to measure the ability of the product to dissipate an electrostatic charge, and the electrostatic voltmeter is used to determine the presence of, or degree of the self-generated charge on a dynamic application (116).

The beta-ray gage, which is being used in the accurate measurement and control of products made in continuous sheet form, uses as a source of radiation an artificial radioisotope, Strontium 90, prepared at Oak Ridge (117).

To measure the pliant flow of rubberlike materials, an apparatus has been developed which should be useful in studying the properties and behavior of packings, printing rolls, offset-printing blankets, and so on, and the tendency of tires to grip or skid (118).

To speed up the measurement of the load-deflection properties of vibration-control mountings and of the elastomers used for vibration control, an improved machine has been developed whereby the speed-up is accomplished by means of an autographic recorder (119).

Although a number of elastomers resistant to low temperatures have been developed recently, relatively little work has been done in standardizing the instruments and procedures used in evaluating their low-temperature properties. Recently studies have been made of the following low-temperature test instruments and procedures: Admiralty indentometer, Gehman torsional tester, Clash-berg torsion test, temperature-retraction test, low-temperature extension test, Gehman low-temperature flexibility test, compression set, stress-relaxation test, Shore hardness, rate of retraction, and refractive index (120, 121, 122, 123).

Another method for testing the flexibility of elastomers at temperatures down to —80 F has been developed which has proved particularly useful in comparing the effects of different plasticizing systems (124). An investigation of the modulus of elastomers at low temperatures has led to the conclusion that under prolonged constant strain at a low temperature greater than the second-order transition temperature, all elastomers show some crystallization, and this crystallization depresses the stress (125). The temperature-retraction test has been found to be useful for the determination of the freezing point of elastomers and their tendency to crystallize (126). Gaskets for low-temperature service give better performance when made of butadiene-styrene rubbers with different ratios of these constituents and/or different polymerization temperatures than standard GR-S, according to cold-compression-set tests performed at —35 F (127). The best plasticizers for reducing the cold compression set of GR-S at —35 F have been selected from a total of 181 plasticizers (128).

OZONE DEGRADATION

Investigations of the action of ozone on rubber have been continued in the past year. A recently developed method for analyzing the results of ozone-cracking is based on the fact that when crack growth takes place, the depth increases proportionally (129). Various factors affecting the ozone resistance of rubber have been studied (130, 131). It has been shown by experiment that the type of carbon black used in rubber does not affect the rate or degree of cracking of the compounds upon exposure to either sunlight or ozone when under static stress (132). The resistance of neoprene to ozone attack has been found to be affected adversely by fillers, and certain plasticizers, softeners, and extenders, while some antioxidants increased the ozone resistance. Some nondiscoloring-type antioxidants are harmful to the ozone resistance of neoprene (133).

In general, the "frosting" of rubber, which experiments show is due to slow oxidation produced or catalyzed by ozone, is minimized or prevented by antioxidants, certain accelerators, reclaim made by the alkali process, latex-sprayed rubber, and strongly oxidized rubber. Frosting is promoted by vulcanizing in ammonia gas, an insufficiency or excess of certain accelerators, rosin, mineral oils, cotton flock, prolonged mastication of the rubber before addition of compounding ingredients, and ozonizing rubber before mastication (134).

A study of the ozone-cracking of natural rubber, standard GR-S, and low-temperature GR-S at several elongations and temperatures showed that the natural-rubber compound cracked at lower temperatures and elongations than either standard or low-temperature GR-S, and for each temperature there existed an elongation below which no sample cracked (135). An investigation has been made of the possibility of using infrared spectrographic techniques to measure ozone degradation by compositional changes rather than the conventional variation in physical properties (136). Rubber products exposed to the atmosphere in the Los Angeles area developed characteristic ozone-cracking more rapidly than in most other parts of the United States (137). Studies of the action of ozone on rubber have proved useful in the quantitative determination of atmospheric ozone (138, 139).

It is hoped that this survey will illustrate to the engineer the types of problems with which the rubber technologist is confronted, and that co-operation with the engineer is essential in solving many of these problems.

BIBLIOGRAPHY

1 *Akron Beacon Journal*, December 15, 1951.
2 *Akron Beacon Journal*, April 19, 1952.
3 *Akron Beacon Journal*, March 26, 1952.
4 "Rubber Act Extended for Twenty-One Months; Requires RFC Disposal Plan, by March 1, 1953," *Rubber Age*, vol. 71, July, 1952, p. 516.
5 *Akron Beacon Journal*, September 17, 1952.

6 "Paley Commission Report on Rubber "(Chapter 20, "Rubber—Natural and Synthetic," from President's Materials Policy Commission Report of June 23, 1952, William S. Paley, chairman of the commission), *India Rubber World*, vol. 126, July, 1952, pp. 501–504.

7 *Akron Beacon Journal*, November 18, 1951.

8 "NPA Removes Restrictions on Purchase of Cold Government-Produced Synthetic Rubber," *Rubber Age*, vol. 71, September, 1952, p. 788.

9 "Cold Rubber Saves $700,000,000," by J. F. Kuebler, *Akron Beacon Journal*, September 5, 1952.

10 "Rubber," by J. T. Cox, Jr., *Chemical and Engineering News*, vol. 30, January 7, 1952, pp. 20–21.

11 "GR-S Latex—1951," by L. H. Howland and V. C. Neklutin, *India Rubber World*, vol. 126, June, 1952, pp. 371–372.

12 "Hevea Latex During 1951," by C. R. Peaker, *India Rubber World*, vol. 126, June, 1952, pp. 372–373.

13 "A Preventive Program to Meet a Coming Rubber Shortage," by P. W. Litchfield, Notes on America's Rubber Industry, New Series No. 18, April 30, 1952, 2 pp.

14 "Paley Report Predicts Rubber Consumption to Double by 1975; Rubber Act Extended for 21 Months," *India Rubber World*, vol. 126, July, 1952, pp. 518–519.

15 *Akron Beacon Journal*, June 22, 1951.

16 *Akron Beacon Journal*, May 14, 1952.

17 *Akron Beacon Journal*, August 15, 1952.

18 *Akron Beacon Journal*, August 22, 1951.

19 *Akron Beacon Journal*, September 13, 1951.

20 *Akron Beacon Journal*, March 16, 1952.

21 "GR-S Price Likely to Remain at 23¢; Butadiene Now 18¢," *India Rubber World*, vol. 127, October, 1952, p. 95.

22 "Akron Companies Keeping Hopeful Watch on Brazil Plan to Spur Rubber Growing," by R. C. Sutliff, *Akron Beacon Journal*, April 27, 1952.

23 "A Living Stockpile for National Security," by P. W. Litchfield, Notes on America's Rubber Industry, New Series No. 16, December, 1951, 4 pp.

24 "Possibilities of Developing Rubber Culture in Africa," by M. Bocquet, *Revue Generale du Caoutchouc*, vol. 28, July, 1951, pp. 453–458.

25 "Butadiene-Styrene Rubbers. Some Effects of Polymerization Temperature and Molecular Weight," by J. R. Beatty and B. M. G. Zwicker, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 742–752.

26 "Speed Up Cold Rubber Output," *Chemical Engineering*, vol. 59, January, 1952, p. 220.

27 "The Production and Utilization of High-Mooney-Viscosity Synthetic Rubber," by H. D. Harrington, K. V. Weinstock, N. R. Legge, and E. B. Storey, *India Rubber World*, vol. 124, July, 1951, pp. 435–442; August, 1951, pp. 571–575.

28 "Recent Developments in the Field of Oil-Enriched Rubbers," by K. V. Weinstock, L. M. Baker, and D. H. Jones, *Rubber Age*, vol. 70, December, 1951, pp. 333–338.

29 "New Process Adds 25% More Cold Rubber," *Chemical Engineering*, vol. 59, March, 1952, p. 213.

30 "Seventh Foundation Lecture of the Institution of the Rubber Industry, on the Economic and Physical Aspects of GR-S Modifications," presented by R. P. Dinsmore in Wolverhampton, England, May 23, 1952; abstract, *Rubber Age*, New York, N. Y., vol. 71, April, 1952, p. 371.

31 "The Effects of Oils in Rubber," by Ira Williams, paper presented at the Rubber Division, American Chemical Society meeting, Cincinnati, Ohio, on May 1, 1952; abstract, *India Rubber World*, vol. 126, April, 1952, p. 87.

32 "Determination of the Hydrocarbon Type of Petroleum Products and Its Significance for Rubber Compounding," by F. S. Rostler and R. M. White, *Rubber Age*, vol. 70, March, 1952, pp. 735–747.

33 "Code and Specifications for Identification of Plasticizers From Petroleum," by F. S. Rostler, *Rubber Age*, vol. 71, May, 1952, pp. 223–228.

34 "Hydrocarbon Composition of Rubber Processing Oils," by S. S. Kurtz, Jr., and C. C. Martin, paper presented at the Rubber Division, American Chemical Society meeting, Cincinnati, Ohio, May 1, 1952; abstract, *Rubber Age*, vol. 70, March, 1952, p. 753.

35 "Chlorosulfonated Polythene. I. A New Elastomer," by R. E. Brooks, D. E. Strain, and A. McAlevy, paper presented at the Rubber Division, American Chemical Society meeting, Cincinnati, Ohio, April 30, 1952; abstract, *India Rubber World*, vol. 126, April, 1952, p. 86.

36 "Chlorosulfonated Polythene. II. Metal Oxide Curing Systems," by M. A. Smook, I. D. Roche, W. B. Clark, and O. G. Youngquist, paper presented at the Rubber Division, American Chemical Society meeting, Cincinnati, Ohio, April 30, 1952; abstract, *India Rubber World*, vol. 126, April, 1952, p. 86.

37 "Chlorosulfonated Polythene. III. Organic Curing Agents," by W. F. Busse and M. A. Smook, paper presented at the Rubber Division, American Chemical Society meeting, Cincinnati, Ohio, April 30, 1952; abstract, *India Rubber World*, vol. 126, April, 1952, p. 86.

38 "Hypalon S-2—A New Elastomer," by R. R. Warner, *Rubber Age*, vol. 71, May, 1952, pp. 205–221.

39 "The Alfin Rubbers—A New Type of Polymer," by A. A. Morton, paper presented at the meeting of the Buffalo Rubber Group on March 4, 1952.

40 "Polymerization Reactions With Alfin Catalysts," by R. A. Stewart and H. L. Williams, paper presented at the Rubber Division, American Chemical Society meeting, Cincinnati, Ohio, May 1, 1952; abstract, *India Rubber World*, vol. 126, April, 1952, p. 88.

41 "Structure of Alkali Metal-Catalyzed Butadiene Polymers," by A. W. Meyer, R. R. Hampton, and J. A. Davison, *Journal of the American Chemical Society*, vol. 74, May 5, 1952, pp. 2294–2296.

42 "An Improved Neoprene—Type WRT," by R. R. Radcliff, *India Rubber World*, vol. 125, December, 1951, pp. 311–314.

43 "Polymerization of 2,3-Difluorobutadiene and 2-Chloro-3-Fluorobutadiene," by L. B. Wakefield, *Industrial and Engineering Chemistry*, vol. 43, October, 1951, pp. 2363–2366.

44 "New Rubber Avoids Use of Styrene," by J. E. Kuebler, *Akron Beacon Journal*, December 5, 1951.

45 "Highly Cross-Linked Polybutadiene, Preparation and Mechanical Behavior," by J. A. Coffman, *Industrial and Engineering Chemistry*, vol. 44, June, 1952, pp. 1421–1428.

46 "Rubber Recovery From Freshly Harvested Guayule," by K. W. Taylor and R. L. Chubb, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 879–882.

47 "Development of Pilot Plant Control for Milling Guayule Shrub," by K. W. Taylor and R. L. Chubb, *Industrial and Engineering Chemistry*, vol. 44, April 1952, pp. 883–887.

48 "Agriculture Department Cites Guayule Truck Tire Findings, *Rubber Age*, vol. 70, March, 1952, p. 764.

49 "GR-S Latices in Foam Rubber," by L. Talalay and A. Talalay, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 791–795

50 "Sulfonyl Hydrazide Blowing Agents for Rubber and Plastics," by B. A. Hunter and D. L. Schoene, *Industrial and Engineering Chemistry*, vol. 44, January, 1952, pp. 119–122.

51 "Protection of Cellular Rubber, Action of Nickel Dibutyldithiocarbamate on the Photodegradation of Natural Rubber," by C. Pinazzi, *Revue Generale du Caoutchouc*, vol. 28, August, 1951, pp. 567–570.

52 "No Styrene, No Odor," *Chemical Week*, vol. 70, April 19, 1952, p. 54.

53 "Synthetic Rubber Latex Developments," by L. H. Howland, V. C. Neklutin, R. W. Brown, and H. G. Werner, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 762–769.

54 "Film From Mixtures of Natural and Synthetic Rubber Latex," by R. M. Pierson, R. J. Coleman, T. H. Rogers, Jr., D. W. Peabody, and J. D. D'Ianni, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 769–773.

55 "Water Vapor Permeability and Sorption of Hevea Latex Films," by W. W. Bowler, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 787–791.

56 "Use of Rubber Latex in Cement Compounds," by L. H. Griffiths, *India Rubber Journal*, vol. 122, February 23, 1952, pp. 304–307, 315.

57 "Butadiene-Styrene Latex Paints for Exterior Use," by L. L. Ryden, L. G. Treat, and D. A. Taber, Official Digest Federation Paint & Varnish Production Clubs No. 329, pp. 357–364, June, 1952.

58 "How to Slash Devulcanizing Time," *Chemical Engineering*, vol. 58, July 1951, pp. 192, 194.

59 "Compounding Reclaim With New Elastomers for High Quality at Low Cost," by M. F. Torrence and H. G. Schwartz, *Rubber Age*, vol. 71, June, 1952, pp. 357–360.

60 "Fluorocarbon Plastics Bonded to Metals and Rubbers to Provide New Composite Materials," *Materials and Methods*, vol. 35, March, 1952, pp. 96–97.

61 "Polyisocyanates in Bonding; Rubber to Metals," by T. J. Meyrick and J. T. Watts, *India Rubber Journal*, vol. 122, March 29, 1952, pp. 505–506.

62 "Carbon Black Flocculation in Rubber to Metal Cements," by G. M. Sheehan, G. Kraus, and A. B. Conciatori, *Industrial and Engineering Chemistry*, vol. 44, March, 1952, pp. 580–582.

63 "Silicone Rubber Can Now Be Bonded," by R. S. Johannsen, *General Electric Review*, vol. 55, February, 1952, pp. 54–57.

64 "Nitrile Rubber Gaskets Make Better Seals," by T. C. Aitchison and B. N. Bowers, *General Electric Review*, vol. 55, March, 1952, pp. 46–49.

65 "A New Rotary Seal for High-Speed and High-Pressure Applications," by T. J. McCuistion, *India Rubber World*, vol. 125, February, 1952, pp. 575–578, 581.

66 "Comparison Between Synthetic and Natural Rubber Pipe-Joint Rings," by W. L. White, *Journal of the American Water Works Association*, vol. 43, November, 1951, pp. 872–876.

67 "Elastic Rubber Cushion Springs for Torque Load Applica-

tions," by R. Iredell, *Product Engineering*, vol. 23, March, 1952, pp. 119–123.

68 "Transmission of Mechanical Vibrations Through Rubbers," by R. E. Morris, R. R. James, and H. L. Snyder, *Industrial and Engineering Chemistry*, vol. 43, November, 1951, pp. 2540–2547.

69 "Development and Testing of a Series of Rubber Suspension Units," by A. E. Moulton, Trans. Institution of the Rubber Industry, vol. 27, December, 1951, pp. 313–321.

70 "Self-Charging Electrostatic Air Filters," by W. T. van Orman and H. A. Endres, *Heating, Piping and Air Conditioning*, vol. 24, January, 1952, pp. 157–163.

71 "Why Rubber-Phenolics?" *Modern Plastics*, vol. 29, February, 1952, pp. 71–77.

72 "The Physics of the Mechanical Removal of Ice From Aircraft," by D. L. Loughborough, *Aeronautical Engineering Review*, vol. 11, February, 1952, pp. 29–34.

73 "Evaluation of Tread Wear," by D. G. Stechert and T. D. Bolt, *Analytical Chemistry*, vol. 23, November, 1951, pp. 1641–1646.

74 "Some Factors Influencing the Road Wear of Tires," by R. D. Stiehler, M. N. Steel, and J. Mandel, Trans. Institution of the Rubber Industry, vol. 27, December, 1951, pp. 298–312.

75 "Tread Wear of Tires," by J. Mandel, M. N. Steel, and R. D. Stiehler, *Industrial and Engineering Chemistry*, vol. 43, December, 1951, pp. 2901–2908.

76 "Vibration Characteristics of Tread Stocks," by K. E. Gui, C. S. Wilkinson, Jr., and S. D. Gehman, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 720–723.

77 "Cottonseed Meal as a Tire Cord-to-Rubber Adhesive," by W. H. Hoffman, Jr., and J. C. Arthur, Jr., *Rubber Age*, vol. 71, June, 1952, pp. 354–356.

78 "Polyisocyanates in Bonding; Terylene Polyester Fiber to Rubber," by T. J. Meyrick and J. T. Watts, *India Rubber Journal*, vol. 122, March 22, 1952, pp. 467–468.

79 "Improvement of the Adherence of Bicycle or Motor Tire Cord to Synthetic Rubber," by E. Profft, *Revue Generale du Caoutchouc*, vol. 29, June, 1952, pp. 409–411.

80 "Evaluating Dynamic Fatigue of Adhesion of Tire Cords to Rubber Stocks," by W. J. Lyons, *Analytical Chemistry*, vol. 23, September, 1951, pp. 1255–1259.

81 "Effect of a Dynamic Fatigue Test on the Mechanical Properties of Tire Cords," by J. N. Grant, Geraldine M. Couturier, and Mary W. Rhodes, *Textile Research Journal*, vol. 21, December, 1951, pp. 867–875.

82 "Thermal Degradation in Tire Cords. I. Effects on Strength, Elongation and Degree of Polymerization," by C. M. Conrad, V. W. Tripp, and Trinidad Mares, *Textile Research Journal*, vol. 21, October, 1951, pp. 726–739.

83 "Thermal Degradation in Tire Cords. II. Effects on Strength, Elongation and Degree of Resilience," by V. W. Tripp, Trinidad Mares, and C. M. Conrad, *Textile Research Journal*, vol. 21, November, 1951, pp. 840–846.

84 "The Properties of Rubber Vulcanizates and Cord Upon Rapid Deformation," by P. Kainradl and F. Handler, *Kautschuk und Gummi*, vol. 5, February, 1952, pp. WT 22–27.

85 "Alkaryl Sulfonates as Conditioners in Wet Twisting Cotton Tire Cord," by J. C. Ambelang, J. A. Shotton, G. W. Gottschalk, H. P. Stevens, and G. E. P. Smith, Jr., paper presented at the Rubber Division, American Chemical Society meeting, Cincinnati, Ohio, April 30, 1952; abstract in *India Rubber World*, vol. 126, April, 1952, p. 87.

86 "Carbon Black Differentiation by Electrical Resistance of Vulcanizates," by J. E. McKinney and F. L. Roth, *Industrial and Engineering Chemistry*, vol. 44, January, 1952, pp. 159–163.

87 "Autoradiographic Technique With Carbon 14 in Rubber," by A. D. Kirshenbaum, C. W. Hoffman, and A. V. Grosse, *Analytical Chemistry*, vol. 23, October, 1951, pp. 1440–1445.

88 "Studies in the Dispersion of SRF Carbon Black in Butyl Rubber," by F. P. Ford and A. Y. Mottilau, *Rubber Age*, vol. 70, January, 1952, pp. 457–463.

89 "Carbon Black Dispersion and Reinforcement," by F. M. Dannenberg, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 813–818.

90 "Some Problems of Butyl Rubber-Carbon Black Systems," by F. P. Ford and A. M. Gessler, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 819–824.

91 "Carbon Gel as Revealed by the Electron Microscope," by W. A. Ladd and N. W. Ladd, *Industrial and Engineering Chemistry*, vol. 43, November, 1951, pp. 2564–2568.

92 "Lignin-Reinforced Nitrile, Neoprene, and Natural Rubbers," by J. J. Keilen, W. K. Dougherty, and W. R. Cook, *Industrial and Engineering Chemistry*, vol. 44, January, 1952, pp. 163–167.

93 "Reduction by Fillers of the Permeability of Natural Rubber to Gases," by P. Thirion, *Revue Generale du Caoutchouc*, vol. 28, October, 1951, pp. 684–691.

94 "Nondestructive Aging Tests for Rubber," by R. F. Shaw and S. R. Adams, *Analytical Chemistry*, vol. 23, November, 1951, p. 1649.

95 "Deterioration of Rubber Under the Influence of Light and Dry and Moist Heat," by A. L. Soden, Trans. Institution of the Rubber Industry, vol. 27, August, 1951, pp. 223–231.

96 "Relation Between Stress Relaxation and Aging Resistance of Rubber Vulcanizates; Some Preliminary Investigations," by H. L. Pedersen and B. Nielsen, *Journal of Polymer Sciences*, vol. 7, August–September, 1951, pp. 97–103.

97 "Elementary Aspects of Rubber Abrasion," by A. Schallmach, paper presented at the Symposium on Abrasion, Delft, Holland, November 14 and 15, 1951; abstract, *India Rubber Journal*, vol. 122, November 24, 1951, p. 843.

98 "Abrasion and Wear of Rubber; Analysis of Wear Curves," by J. M. Buist, *India Rubber Journal*, vol. 121, August, 1951, pp. 180–182.

99 "Wear Resistance of Vulcanized Elastomers," by J. C. Burns and E. B. Storey, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 825–830.

100 "Abrasion Resistance of GR-S Vulcanizates," by J. W. Adams, J. A. Reynolds, W. E. Messer, and L. H. Howland, *Rubber Chemistry and Technology*, vol. 25, April–June, 1952, pp. 191–208.

101 "Permeability of Rubber to Organic Liquids," by W. J. Mueller, paper presented at the Rubber Division, American Chemical Society meeting, Cincinnati, Ohio, April 30, 1952; abstract, *India Rubber World*, vol. 126, April, 1952, p. 86.

102 "Elasticity of Soft Polymers; Constant-Stress Elongation Tests," by C. A. Dahlquist, J. O. Hendricks, and N. W. Taylor, *Industrial and Engineering Chemistry*, vol. 43, June, 1951, pp. 1404–1410; *Rubber Chemistry and Technology*, vol. 25, January–March, 1952, pp. 56–70.

103 "An Electrical Extensometer for Determining Elongation of Elastomers," by C. H. Klute, C. J. Penther, and L. B. McKee, ASTM Bulletin, No. 180, February, 1952, pp. 44–49.

104 "Effect of Temperature and Rate of Stretching on the Tensile Strength of Vulcanizates," by B. A. Dogadkin and D. M. Sandomirskii, *Kolloidnyi Zhurnal*, vol. 13, July–August, 1951, pp. 267–272; *Rubber Chemistry and Technology*, vol. 25, January–March, 1952, pp. 50–55.

105 "Relationships Between the Physical Properties of Rubber Used in Engineering," by S. G. Leontein, Trans. Institution of the Rubber Industry, vol. 28, February, 1952, pp. 27–72.

106 "Relationship Between 'Modulus' and 'Strain' in Pure Gum Natural Rubber Vulcanizates," by R. F. Blackwell, Trans. Institution of the Rubber Industry, vol. 28, April, 1952, pp. 75–84.

107 "The Measurement of the Dynamic Modulus of Elastomers by Vector Subtraction Method," by C. W. Painter, ASTM Bulletin No. 177, October, 1951, pp. 45–47.

108 "Apparatus for the Measurement of the Dynamic Shear Modulus and Hysteresis of Rubber at Low Frequencies," by W. R. Fletcher, *Journal of Scientific Instruments*, vol. 29, June, 1952, pp. 186–188.

109 "Recording Torsion Pendulum for the Measurement of the Dynamic Mechanical Properties of Plastics and Rubbers," by L. E. Nielsen, *Review of Scientific Instruments*, vol. 22, September, 1951, pp. 690–693.

110 "Temperature Dependence of Dynamic Properties of Elastomers; Relaxation Distributions," by J. D. Ferry, E. R. Fitzgerald, L. D. Grandine, Jr., and M. L. Williams, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 703–707.

111 "Correlation of Dynamic and Static Measurements on Rubber-like Materials," by R. D. Andrews, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 707–715.

112 "An Electrical Analog Method for Explaining Elastomer Behavior," by R. B. Stambaugh, paper presented at the 12th International Congress of Pure and Applied Chemistry, September 10, 1951; abstract, *Rubber Age*, vol. 69, August, 1951, p. 583.

113 "Behavior of Elastomers at Small Torsions," by K. H. Meyer, A. J. A. van der Wyk and W. Gonon, paper presented at the 12th International Congress of Pure and Applied Chemistry, September 10, 1951; abstract, *Rubber Age*, vol. 69, August, 1951, p. 583.

114 "Quantitative Determination of Natural Rubber Hydrocarbon by Refractive Index Measurements," by R. H. Fanning and N. Bekkedahl, *Analytical Chemistry*, vol. 23, November, 1951, pp. 1653–1656.

115 "Photoelectric Interferometer for High Polymer Research," *Rubber Age*, vol. 70, November, 1951, pp. 216–217.

116 "Electrostatic Potential 'Bleed-Off' in Rubber Compounds," by J. A. Hurry, T. D. Bolt, and W. E. French, *India Rubber World*, vol. 124, September, 1951, pp. 689–695.

117 "Use of the Beta Ray Gage in the Rubber Industry," by G. B. Foster, Paper presented at the Rubber Division, American Chemical Society meeting, Cincinnati, Ohio, May 1, 1952; abstract, *India Rubber World*, vol. 126, April, 1952, p. 87.

118 "Pliant Flow of Rubber and Similar Industrial Raw Materials," by J. Bekk, *Kautschuk und Gummi*, vol. 4, July, 1951, pp. 250–253.

119 "Measuring the Load-Deflection Properties of Vibration-Control Mountings and of Elastomers," *Rubber Age*, vol. 70, January, 1952, pp. 475–476.

(*Continued on page 646*)

THE ASME BOILER CODE

*VIII Revisions by Annulment of Cases—1936–1937**

By ARTHUR M. GREENE, JR.

PRINCETON UNIVERSITY, PRINCETON, N. J. HONORARY MEMBER ASME

SPHERICAL AND HEMISPHERICAL HEADS

H. C. Boardman presented an inquiry from the Chicago Bridge and Iron Works regarding field construction of cylinders with hemispherical heads half as thick as the shells to be used for gas storage. The shell was tapered down to the thickness of the head at the butt end for welding to the head plates. As this was the reverse of the ordinary procedure with shop welding with basket or ellipsoidal heads under Pars. U-68 and U-69, it asked if this tapering was permissible to qualify the vessel for the Code stamp. It was asked also if it would be better to build the shell of full thickness at the end and provide transition fillets to permit a taper between the shell and head plates. E. R. Fish stated (Feb. 28, 1936) that his Subcommittee on Unfired Pressure Vessels believed that the Code should apply to hemispherical heads as well as to other heads. The intent of the Code would be met if the provisions of Par. U-36(*g*) for semi-ellipsoidal forms of heads should be applied to these heads for thickness. If the heads were made of more than one piece, the thickness must be determined by including the efficiency of the weld. Pars. U-72(*c*), (*d*), and (*e*) would govern the adjustment of thickness at the edge of head and shell. The subject was then referred to the Special Committee to Revise Section VIII.

On April 16, 1937, a letter was presented from Perry Cassidy of the Babcock & Wilcox Company that the company wished to use blank hemispherical heads on fusion-welded vessels according to the Code rules. These heads would be blanks differing from those of the Code with openings. The design rules devised by them and submitted produced no cross strains where the heads were attached to the shell. The rules had been checked and approved by D. B. Wesstrom and D. B. Rossheim. Mr. Wesstrom stated that although the rules were theoretically correct and of the finest type they were too complicated for introduction into the code although this did not affect the adequacy of the given design. The rules were submitted to the Subcommittee on Special Design with the request that it prepare suitable rules and formulas to make this type of construction available for pressure vessels and boilers under Code requirements.

A letter from Mr. Cassidy stated that his company had sold two boilers for pressures of 2200 psi and 2500 psi to be made with forged steel steam and water drums using S-27 material of 70,000 psi minimum tensile strength. As these drums could not be forged with heads it was desired to use welded heads, according to the rules he had presented, which contained no openings to cause stress concentration. The Committee recommended to the state authorities where the boilers were to be installed that the heads in question be sanctioned as a special installation.

H. C. Boardman advised the Boiler Code Committee on Sept. 17, 1937, that the Chicago Bridge and Iron Company wished to build structures made of two or more intersecting spheres with a pierced equalizing opening in the diaphragm on each plane of intersection. He asked if this design would meet Code requirements provided the design complied with the Code rules except for the special shape. This inquiry was referred to the Subcommittee on Special Design. The report of the Subcommittee on Oct. 28, 1937, stated that if the thickness of the diaphragms were so proportioned as to result in equal stresses, in pounds per square inch, in all connected members, it was of the opinion that the resulting design would be free of bending stresses and could be considered acceptable under Code requirements for all vessels in which x-ray examination of the welded seams was not required and also that the formula for spherical vessels in Case No. 840 might be used. The Boiler Code Committee accepted the report and voted to transmit the intent thereof to the inquirer.

WELDING STAY BOLTS TO PLATES

The subject of welding stay bolts to plates for low-pressure heating boilers was brought before the Committee a number of times during this period of revisions, but no definite action could be taken before the issues of the various sections in 1937.

TESTING BEFORE SEAL-WELDING OF RIVETED JOINTS

The Committee had been requested to delete the requirement of Par. P-257 that seal-welding should not be applied until the boiler had been made tight as evidenced by the regular hydrostatic test of Par. P-329. Although several members of the Committee favored this deletion, a majority favored its retention for many reasons.

FUSION-WELDED LOCOMOTIVE BOILERS

On April 24, 1936, James Partington presented to the Committee blue prints of a proposed method of welding an attachment for the front tube sheet of an experimental locomotive to be built by the American Locomotive Company for the Delaware and Hudson Railroad Company. The construction of this locomotive had been permitted by the Interstate Commerce Commission as an experimental installation under rigorous conditions of frequent inspection in operation. The boiler drawing had been submitted to the Committee on Locomotive Construction of the Association of American Railways and approved by them. It was also stated that the boiler would comply with the ASME Code Rules for Welding.

The attachment for the front tube sheet was not in accordance with any existing Code rules. It was proposed to attach the tube sheet to a rectangular ring with filleted welds on each side to the inside of the first cylinder course of the boiler. Approval of this design was requested so as to advise the AAR Committee on Design of the Boiler Code Committee's reaction. The Committee voted to permit this construction for the welded locomotive boiler as an experimental installation. This locomotive boiler became the first fusion-welded locomotive and steps leading to its approval by ICC and data on its operation will be noted in a later chapter.

VESSELS SUBJECT TO COLLAPSE

The Rules for Vessels Subject to External Pressure which appeared in the 1934 edition of the Code had resulted from the

* This section continued from the July, 1953, issue of MECHANICAL ENGINEERING.

theoretical studies of experimental results on certain ferrous metals listed in Par. U-120, but during the years 1936–1937 several requests were made of the chairman of the Subcommittee, W. D. Halsey, to include rules applying to other ferrous as well as nonferrous metals. On April 16, 1937, Mr. Halsey reported that D. F. Windenberg of the Special Research Committee had prepared a report on the basis of the theoretical and empirical equations used in the rules of this portion of Section VIII and advised its publication. The Boiler Code approved the publication and extended its thanks for this comprehensive report to Mr. Windenburg.

The importance of rules for the application of external pressure to vessels made of cast iron, cast steel, aluminum, copper, and other ferrous and nonferrous materials was brought to the attention of W. D. Halsey, chairman of the Special Research Committee on Vessels Subject to External Pressure, by a letter from D. S. Jacobus, chairman of the Executive Committee of the Boiler Code Committee on Oct. 6, 1937. The letter pointed out the insistent demands of many manufacturers desiring to use such materials for vessels under external pressure.

STRESS RELIEVING

A number of manufacturers applied for permission to omit the stress relief of their vessels but except for the modification of Pars. U-69 and U-76 as mentioned in the Report on the Conference on Specification S-26 no changes could be formulated. Tests to determine the efficacy of stress relieving were proposed and on Dec. 3, 1937, H. C. Boardman, stated that at the recent meeting of the Industrial Research Division of the Welding Research Committee of The Engineering Foundation he had been designated as a special committee to make a study of the advisability of research work on the stress relieving of pressure vessels. He had made suggestions in discussing the paper on "Locked-Up Stresses" by C. J. Holslag, which he thought would be of great value. Dr. C. A. Adams related former proposals. Mr. Boardman thought that financial aid could be secured from the manufacturers, and the Committee expressed the hope that such tests could be carried out.

API-ASME CODE

The first edition of the API-ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Vapors, published in 1934 as mentioned in the previous chapter, was followed by a second edition in 1936 on the completion of its third Section F, Design and Construction of Integrally Forged Vessels. In addition to this new section of 31 pages, there were minor changes. Some of them were suggested by changes in the ASME Codes. Added ASTM Specifications were placed in the list of available materials for vessels and parts. Five of the Joint Committee of ten were members of the Boiler Code Committee.

MATERIALS

The Subcommittee on Material Specifications presented many reports during this period on matters referred to it on the form of specification which should be made for new materials suggested by the Par. P-1(*b*) and similar paragraphs in other Sections of the Code providing for the submission of such materials for consideration of the Boiler Code Committee as such became available. It also selected ASTM specifications where such were available for a proposed material without change or conferred with ASTM on possible changes to suit new uses. Many of their reports dealt with changes necessary to bring Code specifications into agreement with new altered ASTM Specifications.

The Subcommittees on Ferrous Materials and on Nonferrous Materials had been appointed earlier to determine working stresses at high temperatures, and other properties, when such matters affected the decisions of the Boiler Code Committee. A Special Committee on New Materials to deal with all phases of new materials was appointed at the executive session of the Boiler Code Committee on May 27, 1936. It consisted of the Subcommittees on Ferrous Materials and Nonferrous Materials, each responsible to report on all questions concerning their respective types of materials. All recommendations dealing with specifications and welding practice were to be referred to those Subcommittees before presentation of new materials to the Main Committee. The Subcommittee on New Materials would be responsible for securing recommendations of the Subcommittee on Welding, the AWS Conference Committee, and the Subcommittee on Material Specifications whenever welding or specifications were involved.

The use of steel of S-26 and S-27 with a certain amount of molybdenum to obtain higher strength when the carbon content was not over 0.25 per cent was approved after reference to the Subcommittee on Material Specifications on Feb. 28, 1936. Data on weldability was to be supplied by members of the Boiler Code Committee. Case No. 819 made it permissible to use steel similar to that of S-26 and S-27 for fusion-welded power boiler drums when the carbon was limited to 0.25 per cent and the molybdenum added within a range of 0.25 to 0.60 per cent for S-26 steel and 0.40 to 0.60 per cent for S-27 steel.

The Subcommittee on Ferrous Materials, in fixing the stress limitation of steels of S-1 and also S-26 and S-27 with molybdenum, desired these to be silicon killed with a minimum of 0.15 per cent silicon. The Subcommittee was directed on March 27, 1936, to consult the ASTM through the Subcommittee on Material Specifications on this matter. The revision of the allowable stresses of ferrous materials at elevated temperature was reported at the meeting of April 24, 1936, and accepted for publication in MECHANICAL ENGINEERING. For this table the Subcommittee was guided by short-time properties of materials, ultimate strength and yield point, to which factors of safety of 5 and $2^1/_2$, respectively, were applied and in no case could the allowable stress exceed 80 per cent of the indicated stress which would cause 1 per cent creep in 100,000 hr.

As adverse comments were made regarding the published table for stresses at elevated temperatures, a revised form of Table P-8 was presented on June 26, 1936, but this was referred back to the Subcommittee for further study. On June 26, 1936, A. J. Ely was appointed vice-chairman of the Subcommittee on Ferrous Metals and on Sept. 18, 1936, W. G. Humpton (Lukens Steel Co.), E. F. McKinney (Bethlehem Steel Co.), L. A. Sheldon (General Electric Co.), and E. C. Wright (National Tube Co.) were added to the Subcommittee.

On Jan. 29, 1937, the Subcommittee on Material Specifications reported on 26 of the 34 adopted specifications at that time, questioning the retention of some of them, replacing or revising certain of the later edition of ASTM Specifications, retaining some, and omitting S-14 for the Arbitration Test Bar as this subject was included in the revised S-13 for Gray Iron Castings adapted from ASTM A 48-36. The Subcommittee called attention to nine specifications which should be referred to the Subcommittees on Ferrous and Nonferrous Materials for recommendation to the Boiler Code Committee regarding their incorporation in Section II. This excellent report covered 15 pages of typed matter.

On March 12, 1937, H. B. Oatley, of the Special Committee on New Materials, recommended that certain of the specifications in the 1935 Code questioned by Mr. Cassidy be retained, and of those called to the attention of his Subcommittee, four be omitted from consideration, three adopted, and two reported upon by the Special Committee on Ferrous Materials.

The Subcommittee on Nonferrous Materials reported the

allowable stresses for certain nonferrous materials at varying temperatures on March 12, 1937, to replace the tables approved in September, 1936, by the inclusion of additional materials. On Sept. 17, 1936, the final form of the so-called Table U-3½ was adopted and Table P-7½ for the maximum allowable working pressure for ferrous materials at different temperatures was approved.

In the final determination of the specifications to appear in the 1937 edition of Section II the old specifications from S-1 to S-31 were retained with the exception of S-14 on the Arbitration Test Bar by revising some to agree with later printings of the ASTM Specifications, by bringing some into agreement with those of ASTM, or by adapting some from such standards. As a result of the 30 remaining specifications appearing in the 1935 edition of Section II, 24 were identical with some ASTM Specification, 1 in substantial agreement, 1 based on and 1 adapted from such specifications, and 3 without any ASTM specification for the material.

The new specifications (the first four adopted in 1936 and the remainder in 1937) were:

S-32 (Specification ASTM A 178-37) for Electric-Resistance-Welded Steel and Open-Hearth Iron Boiler Tubes.
S-33 (Specification ASTM A 157-36) for Alloy-Steel Castings for Valves, Flanges, and Fittings for Service at Temperatures of 750 F to 1100 F.
S-34 (Specification ASTM A 158-36) for Seamless Alloy-Steel Pipe for Service at Temperatures of 750 F to 1100 F.
S-35 (Specification ASTM A 182-36) for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for Service at Temperatures from 750 F to 1100 F.
S-36 (Specification ASTM B 96-36T) for Copper-Silicon Alloy Plates and Sheets.
S-37 (Specification ASTM B 98-36T) for Copper-Silicon Alloy Rods, Bars and Shapes.
S-38 (Specification ASTM B 25-36T) for Aluminum Sheet and Plate.
S-39 (Specification ASTM B 79-36T) for Aluminum-Manganese Alloy Sheet and Plate.
S-40 (Specification ASTM A 92-36T) for Seamless Steel Boiler Tubes for High Temperature Service.
S-41 (Specification ASTM B 61-36) for Steam or Valve Bronze Fittings.

The specification S-14 was not replaced by another specification.

MISCELLANEOUS

RULES FOR CONTAINERS FOR GAS AND LIQUIDS AT SUB ZERO TEMPERATURES DOWN TO —150 F (LIQUEFACTION OF SOLID CARBON DIOXIDE)

The need for rules for the construction of vessels to be used for the liquefaction of solid carbon dioxide (dry ice), other than those of the Interstate Commerce Commission Rules, had been brought before the Boiler Code Committee by the Compressed Gas Manufacturers' Association on Jan. 17, 1935. Such tanks were used for storage and not for transportation and it was pointed out that rules included in the Unfired Pressure Vessel Code would be of value to state and municipal inspectors in accepting such containers. At the December meeting, a letter was sent by the Association requesting permission to present information. Five representatives attended the meeting of the Committee on Jan. 17, 1936, at which Col. J. C. Minor presented data from the Association. This organization had been in existence about 25 years and included about 95 per cent of the manufacturers of compressed gases. The Association confined itself to the promotion of safety and did not carry on trade relations of any sort. The appearance of the representatives was to correct any misunderstanding of the Boiler Code Committee regarding rules for carbon-dioxide liquefiers. Colonel Minor presented a letter and advised the Committee of the desire to co-operate in the formulation of the rules. In discussing the letter it was brought out that low temperatures exist at low pressures and that the temperatures at high pressure and the resulting high stresses in the vessel occur at room temperatures. The original letter neglected to make this clear. A special committee consisting of H. Le Roy Whitney, chairman, R. E. Cecil, E. R. Fish, C. W. Obert, and D. B. Wesstrom, was appointed to confer with the Compressed Gas Manufacturers' Association.

The results of several meetings with the Association were reported by Mr. Whitney on March 27, 1936, at which time he presented a set of rules which were unanimously recommended by the Special Committee and the conference members from the Association. Copies of these rules were distributed, and Mr. Whitney pointed out that they were intended to cover containers of gases and liquids at subzero temperatures but not lower than minus 150 F. It was stated also that the rules had been approved by the Subcommittee on Ferrous Materials. It was pointed out that the report did not bring out the merits of the construction clearly and that additional descriptive matter should be added to the sketch to show the way in which the thickness of the shell was gradually increased at the head with the filling opening and another drilled opening to avoid high stress concentration. Dr. D. S. Jacobus considered this to be a most important case as it was an initial one in which a lower factor of safety could be used for a seamless shell without holes with resulting stress concentration than could be used for vessels with holes. The requirement that no holes should be permitted in the shell should be clearly covered. He believed that the title should be changed to designate more clearly the use for which the vessel could be employed.

After discussion and the agreement on several suggested modifications and the inclusion of one or two acceptable forms of vessels, the proposed amended rules were adopted, and publication in MECHANICAL ENGINEERING was directed as an addition to the Unfired Pressure Vessel Code. The title was changed to Rules for Containers for Gas and Liquids at Sub-Zero Temperatures Down to —150 F.

Certain minor revisions were made on June 26, 1931, as a result of the publication of the proposed rules in MECHANICAL ENGINEERING for May, 1936.

The rules were issued as part of the Code in August, 1936, becoming Pars. U-140 to U-144 of Section VIII.

On April 16, 1937, objection was raised by the Carbonic Gas Equipment Company because the rules differed from those of the Interstate Commerce Commission which the company had been using and permission was asked to depart from Section VIII. This, of course, the Committee could not do as it was not the administrator of the Code. On July 28, 1937, however, on account of the difficulty with the impact test, the Executive Committee replied that if the factor of safety of 5 was used in place of 4 in the design of dry-ice converters they could be built according to other paragraphs of Section VIII of the Code.

UNFIRED STEAM BOILERS

As electrically operated steam generators were found in certain stations, a statement was added to Par. U-2 on March 27, 1936, to the effect that those unfired pressure vessels which generated steam for power or heat to be used externally to themselves were to be classed as unfired steam boilers. These vessels might be constructed under the appropriate classification of the Unfired Pressure Vessel Code and equipped with safety devices required by the Power Boiler Code for the service of the particular installation.

SIZE OF HAND HOLES

For many months the minimum size of hand holes had been brought to the Committee by W. H. Furman, an active member of the Conference Committee, and on May 27, 1936, the subject was referred to the Subcommittee on Special Design for a report. After an earlier report the size adopted on March 12, 1937, was $2^3/_4$ in. $\times$ $3^1/_4$ in. with the added clause "but it is recommended that, where possible, larger sizes be used."

FUSIBLE PLUGS

During this period the rules relating to fusible plugs were revised to bring them into agreement with those of the Steamboat Inspection Service. These revisions were published in MECHANICAL ENGINEERING for June, 1935. The Service Rules did not permit refilling and for this reason Par. A-19(*c*) was revised for uniformity. This and other suggested changes which did not depart from the intent of the former fusible plug rules were adopted on May 27, 1936.

BACKING UP WATER WALLS

A letter from E. H. Mills, chief safety engineer of Detroit, Mich., requesting an opinion on the satisfactory form for the supports for backing up the water walls of a certain cross drum boiler, was reported on Nov. 20, 1936. In this boiler of 450 psi working pressure with $3^1/_4$-in. water-wall tubes of 7-gage material, spaced 6 in. apart, the furnace refractories were supported by 9-in. pieces of 3 $\times$ 3 tee members welded to the tubes. Each bracket carried a dead load of 140 pounds or 700 pounds on each tube. He questioned the practice and found nothing in the Code restricting or prohibiting this practice. The letter having been referred to the Subcommittee on Welding, James Partington, the chairman, reported that the replies from the Subcommittee members indicated that no serious difficulty would arise from this practice. The Subcommittee could not form a reply to which it could give full approval. Some of the Executive Committee stated that in so far as the welding of lugs to tubes might cause failure they saw no reason to fear this practice. Many such types of construction were in use. The reply to Mr. Mills pointed out that there was nothing in the Code to prohibit this practice but such work should be done with careful supervision to assure good welds.

The reply of Mr. Mills, considered at the meeting of Jan. 29, 1937, suggested among other things the advisability of the Committee's preparing requirements for the use of such brackets. One request was received from an inquiring firm, Giffels & Vallet, Inc., desiring an opinion on the construction and method of support for a backing-up scheme which appeared to be the same as that under inquiry.

On discussing these matters the Committee believed that such construction should be covered in the Code and appointed a special committee consisting of C. O. Myers, chairman, E. R. Fish, H. H. Mills, and A. C. Weigel to consider these letters.

On March 12, 1937, it was reported that Mr. Gay of the Babcock & Wilcox Company had prepared a set of rules for the attachment of supports to tubes by fusion welding to cover the general subject of such parts and these rules could be used in backing up water walls. These rules, although without derivation, were referred to the Special Committee for approval with the direction that if approved they should be published in MECHANICAL ENGINEERING as proposed revisions for discussion. The proposal, "Allowable Loading on Structural Attachments to Tube," covered the formula for the maximum load per inch of the length of the attachment to the tube, a chart of allowable loading per inch versus the ratio of outside diameter to wall thickness, and two figures giving five forms of attachments with two pages of text of numerical calculations for four forms of application.

This was approved and appeared as Par. P-186(*e*), "Allowable Loading on Structural Attachments to Tube," with Figs. P-17 and P-18, in the Power Boiler Code of 1937, and under "Example of Computation of Allowable Loading on Structural Attachments to Tube" in the appendix of that edition as Pars. A-70 to A-73.

ACCEPTANCE IN MASSACHUSETTS

The acceptance of Section I of the Code by the Commonwealth of Massachusetts was announced on May 27, 1936, to become effective Nov. 1, 1936, and at this meeting, C. A. Gorton was thanked for his part in bringing about this action by this state, long desired by the Committee.

HYDROSTATIC TEST TO DETERMINE MAXIMUM ALLOWABLE WORKING PRESSURE

During this period six instances were noted of suggestions of tests according to Par. P-247 for determining the allowable working pressure on special structures for which no exact method of design was available.

SAFETY-VALVE REQUIREMENT WITH BOILERS OF DIFFERENT ALLOWABLE PRESSURES ATTACHED TO SAME STEAM MAIN

The inquiry of G. A. Luck of the Massachusetts Board of Boiler Rules relative to a provision in the Code of the safety-valve requirements for boilers having different allowable working pressures when attached to the same header was referred to the National Board of Steam Boiler and Pressure Vessel Inspectors for their recommendation in December, 1936. A letter from the National Board was reported on Jan. 29, 1937, recommending that the Boiler Code Committee take such steps as would be necessary to provide rules and regulations governing the installation of safety valves on any steam header connecting two or more boilers operated at different pressures.

A. C. Weigel pointed out that the National Board had misinterpreted the question. He stated that the Board suggested a safety valve to care for the lower pressure boiler. V. M. Frost pointed out the serious nature of the inquiry and thought that Pars. C-67 and C-152 of Section VII, Care of Power Boiler, gave the answer to this question. W. H. Furman stated that the New York State Code had had provisions covering such installations since 1918 which they found had worked no hardship. Such a provision should be in the Boiler Code.

A Special Committee consisting of I. E. Moultrop and V. M. Frost was appointed to consult the National Board to secure the viewpoints of inspectors and operators and prepare a suitable rule for consideration by the Boiler Code Committee.

I. E. Moultrop reported for the Special Committee a proposed additional paragraph to Par. A-45 at the meeting of Oct. 28, 1937, in which additional safety-valve capacity was added to the low-pressure side of the system. This capacity was to be based on the maximum amount of steam which would flow into the low-pressure system. The additional safety capacity should have at least one valve set at a pressure not to exceed the lowest allowable pressure and the other valves should be set within a range not to exceed three per cent above that pressure. It was voted to include this in Par. A-45 and to send copies of the report to Mr. Luck as an official communication and that it be reported to the National Board. This appeared as Par. A-45 of the 1940 edition of Section I as the 1937 edition had gone to press at the time of approval.

CHANGES IN PERSONNEL

The Boiler Code Committee was saddened by the death of its esteemed second chairman, Fred R. Low, on Jan. 22, 1936, after years of illness, which, although it deprived the Committee of his advice and guidance, never lessened his interest in the activi-

ties of the Committee until the end. Death also deprived the Committee of the loyal services of John Campbell, Conference Committee member from Pennsylvania, on Jan. 3, 1936, W. H. Larkin, Jr. member, Subcommittee on Care of Power Boilers, July 16, 1936, and F. B. Howell, chairman Subcommittee on Low Pressure Heating Boilers, Oct. 10, 1937.

APPOINTMENTS

The following appointments were made:

Jan. 17, 1936, E. W. Smith, member Subcommittee on Welding
Feb. 28, 1936, D. S. Jacobus, chairman, Boiler Code Committee and S. K. Varnes, member, Boiler Code Committee
April 24, 1936, E. R. Fish, vice-chairman, Boiler Code Committee
Jan. 29, 1937, H. E. Aldrich, vice-chairman, Executive Committee
Jan. 29, 1937, V. M. Frost, chairman of Subcommittee on Coordination, with E. R. Fish and C. W. Obert, appointed June 25, 1937
Oct. 26, 1937, C. E. Gorton, acting chairman, Subcommittee on Low Pressure Heating Boilers.

NEW EDITIONS OF CODES

The Codes of 1937 were prepared by publication of proposed revisions in MECHANICAL ENGINEERING, and after a period for criticisms and suggestions, the issuance of addenda sheets following the approval by the ASME Council. New editions of this period received final Council approval in August, 1937.

1937 SECTION I, RULES FOR CONSTRUCTION OF POWER BOILERS

This edition was signed by D. S. Jacobus, the chairman succeeding the late F. R. Low, E. R. Fish, vice-chairman, C. A. Adams, H. E. Aldrich, H. C. Boardman, W. H. Boehm, R. E. Cecil, F. S. Clark, A. J. Ely, V. M. Frost, C. E. Gorton, A. M. Greene, Jr., W. G. Humpton, J. O. Leech, I. E. Moultrop, C. O. Myers, H. B. Oatley, James Partington, Walter Samans, S. K. Varnes, A. C. Weigel, H. LeRoy Whitney, and C. W. Obert, honorary secretary. F. B. Howell, who had signed the 1935 edition, had died Oct. 10, 1937.

There was one new member on the Conference Committee as Massachusetts had adopted Section I of the code.

The preamble classified fired steam boilers as those in which steam was generated by heat from the combustion of fuels to distinguish such boilers from steam generators using electrical energy, hot fluids, or vapors for the production of steam and called unfired steam boilers. It was also required that the material for forced-circulation boilers and boilers with no fixed steam or water line should conform to the requirements of the Code.

Par. P-2(*a*) on boiler plate was enlarged to include a new specification such as occurred in Par. P-11 for materials for superheaters and Par. P-21(*a*) for tubes.

The tables for working pressures in tubes and pipes were those of the 1935 edition except the values were altered so as to use the next higher number ending in zero.

A section Par. P-26 was added to cover nonferrous tubes and pipes which included Table P-8 giving the allowable stresses for various nonferrous metals at temperatures up to 450 F.

The rules for the process of fusion welding beginning at Par. P-101 extended the description of the limits of the use of such welding and enlarged Par. P-102 by the addition of other paragraphs, especially P-102(*i*) as described in this chapter. The list of usable materials was increased by the inclusion of S-18 and S-40.

Par. P-108 called for all pressure parts fusion-welded under Par. P-101 to be stress-relieved, and Par. P-109, Hydrostatic and Hammer Test, was revised to exclude the hammer test on certain vessels. A new section, Par. P-112 on welded pipe connections covered four and one-half pages and gave details as to materials, qualifications of welding processes, and testing of welding operators, including eight figures illustrating the requirements of the text.

The new Par. P-113 gave details for the welding of superheater tubes to tubular manifolds and headers without expanding the tubes and Par. P-114 permitted the fusion welding of front and back sheets of stay-bolted box-type headers for water-tube boilers, provided the flat portion in the trough of the header was not over 90 per cent of the stay-bolt pitch permitted in Par. P-199. P-114 had resulted from the reply by the Boiler Code Committee to an inquiry of a case.

Par. P-186(*c*) on welded joints was enlarged to permit the fusion-welding of the bottom edges of the plates of the water legs in vertical tubular and fire-box boilers, provided the load due to the internal pressure was carried by stay bolting and the water leg was not over four inches wide.

Par. P-186(*e*), Allowable Loading on Structural Attachment to Tubes, with Table P-17 and Fig. 18 was added to the code with the examples of its application in Pars. A-70 to A-73.

Par. P-186(*f*) which had been Par. P-186(*e*) on seal welding was slightly enlarged and an added Fig. P-19 gave the allowable welding conditions of plate edges at ends of butt straps. Par. P-186(*f*) of the 1935 edition became Par. P-186(*g*).

The section on ligaments remained unchanged, while minor changes were made to Par. P-194 on domes. The same was true in the cases of dished heads, Pars. P-195 to P-198, as a small change occurred in the definition of the constant $C = 0.75$. The paragraphs on braced and stayed surfaces, Pars. P-199 to P-229, inclusive, were changed to define the materials for washers in Par. P-199(*a*), and to delete Par. P-207 on water-leg stay bolts.

The section on stays, Pars. P-230 to P-244, were changed to permit the fusion-welding of the longitudinal joint of an Adamson furnace flue.

Some small changes were made in Par. P-249, Tube Holes and Ends in Par. P-258 for the minimum size of hand holes ($2^3/_4 \times 3^1/_2$), and in the use of tapered threads for threaded openings. Par. P-266 on hand holes of vertical boilers was changed slightly by an added paragraph giving details for various types of such boilers.

In the section on nozzle opening, Par. P-268(*b*) was enlarged to include the use of an inserted nozzle opening shown in a new Fig. P-43. The text described the requirement for such an installation.

The safety valve section of the Code, Pars. P-269 to P-290 and A-12 to A-17, necessitated the conference already mentioned at which the final form of these paragraphs was discussed.

Pars. P-291 to P-298, Water and Steam Gages, were changed only in regard to the materials for gage connections. In the Section on Fittings and Appliances, Pars. P-299 to P-322, subparagraphs were added for the use of cast-iron valves under certain conditions, the use of steel valves and fittings, and the use of plug-type valves. Drains for integral economizers, the introduction of feedwater, and water-column details were treated more fully.

The section on settings, Par. P-325, contained an additional subparagraph P-325(*e*) with Fig. P-48 providing for the details of a welded bracket connection for the support of horizontal return tubular boilers. This had resulted from a case. An access door at least 6 in. × 8 in. for inspection and cleaning the bonnet or smoke hood of a vertical flue or tubular boiler was an addition to Par. P-327.

The section on stamping, Pars. P-331 to P-333, was reworded in a number of places to clarify the intent of the paragraphs. The form of stamp now included a statement of the square feet of

boiler heating surface and square feet in water wall. The forms to be used for data reports included the new manufacturers' test report of safety valves as well as the forms Manufacturers' Partial Data Report and the Manufacturers' Data Report on all types of boilers.

Par. A-11 on the method of computing discharge capacity of safety valves from pressure, lift and diameter was deleted for the 1937 edition and new tables, Table A-9 on Pressure-Temperature Ratings for steel flanged fittings and companion flanges and Table A-10 on minimum metal thickness of bodies of cast iron and malleable iron screwed fittings were added.

A sentence added to Par. A-18 on Automatic Water Gages stated that the restrictions of six lettered paragraphs did not apply to closing the valve by external methods.

Pars. A-19 and A-30 on fusible plugs had been amended to conform with marine practice and Par. A-21 on the locations of plugs in 21 different types of steam boiler remained unchanged.

The standard practice for making hydrostatic tests on a boiler pressure part to determine the maximum allowable pressure, Pars. A-22 to A-30, remained unchanged.

The suggested rules covering existing installation, Pars. A-31 to A-62, was not altered except by the omission of reference to the deleted Par. A-11.

The Computation of Openings, Pars. A-63–A-68, was corrected merely by changes in two numerical values in Par. A-64(*b*).

The new examples of computation of allowable loading on structural attachments, Pars. A-70 to A-73, were given on the final two pages of the appendix.

An index of 12 pages for Section I, Power Boilers, Section II, Material Specification, Section VI, Rules for Inspection of Material and Steam Boilers, and the Appendix closed this single volume.

SECTION II, MATERIAL SPECIFICATIONS

Section II of the Code was prepared under the recommendations of the Subcommittee on Material Specifications, consisting of the ASME Conferring Committee, P. R. Cassidy,[1] chairman, A. M. Greene, Jr.,[1] J. O. Leech,[1] and P. J. Smith; the ASTM Conferring Committee, C. L. Warwick, chairman, E. J. Edwards, and C. F. W. Rys; and the AASM Technical Committee Conferring Committee, J. O. Leech, chairman, E. F. Kenney and A. D. Pace. As described earlier this section contained 40 specifications: S-1 to S-13 and S-15 to S-41, extending through 193 pages. The list contained 34 specifications identical with those of the ASTM, one in substantial agreement, one based on an ASTM specification, and one adapted from such while for three specifications there were no ASTM specifications available.

These specifications covered steel, alloy steel and copper sheets and plates, forgings, steel rivets and bars, rolled-steel pipe flanges, alloy-steel bolting material, carbon-steel castings for high-temperature service, gray-iron castings, malleable-iron castings, extra-refined bar iron, iron and steel boiler tubes, steel pipe, wrought-iron pipe, copper bars, copper boiler tubes and pipe, brass pipe, open-hearth iron plates, and high-tensile-strength carbon-steel plate which appeared in the 1935 edition of the Code. The ten remaining specifications have been mentioned earlier.

SECTION III, BOILERS OF LOCOMOTIVES

The 1937 edition of the Code for Boilers of Locomotives was produced under the direction of the same committee that produced the 1935 edition. James Partington,[1] chairman, F. H. Clark, J. J. Hall, and H. B. Oatley.[1]

[1] Member of Boiler Code Committee.

In this the only important change from that of 1935 was the new Table L-2 giving maximum allowable working pressures for steel or wrought-iron tubes of different diameters and sizes conforming to material of S-17 or S-32 in place of the former tables of minimum gages for given diameters and pressures. The pressures of the new table were somewhat higher than those given in the earlier edition. In this table the formula for computing the maximum allowable pressure in terms of diameter and thickness was given. The values in the tables were given as the next higher number ending in zero to that computed by the formula.

After the announcement of the proposed building of the welded locomotive for the Delaware and Hudson Railroad by the progressive action of its president, L. H. Loree, Mr. Partington stated at the meeting of the Boiler Code Committee that his Subcommittee was planning to introduce more use of fusion welding in the Code for Boilers of Locomotives but he would not be able to report suggestions for two years. This was probably for the reason that the date would coincide with the completion of some tests of the D. and H. fusion-welded locomotive boiler and would give the Subcommittee knowledge of its performance.

SECTION IV, CODE FOR LOW-PRESSURE HEATING BOILERS

The 1937 edition of the Code for Low-Pressure Heating Boilers was produced under the direction of the same committee that produced the 1935 edition, although the chairman, F. B. Howell, had died before it was issued. Those signing the 1937 edition were: C. E. Gorton,[1] acting chairman, W. H. Boehm,[1] C. E. Bronson, J. A. Darts, F. W. Herendeen, W. E. Stark, and J. W. Turner.

In this edition the minimum allowable thickness of the tube sheet or heads of Table H-1 were increased by $1/16$ in., while for shells or other plates the thicknesses were reduced by $1/16$ in.

In Par. H-12 all sheets except those having tube holes supported by braces or stay bolts were to be classified as shell plates, and in Par. H-21 the allowable distance from a corner-welded joint to the nearest row of stay bolts might be a full stay pitch as provided in the paragraph on the construction of steel plate low-pressure heating boilers at 15 psi for steam and 30 psi for hot water. In the last paragraph of Par. H-28 the limiting diameter for the requirement of access openings was increased from 24 in. to 28 in.

Pars. H-38 and H-91 were enlarged to prohibit the introduction of feedwater through openings or connections used for the water column, water gage glass, or gage cock, and Pars. H-40 and H-93 described the form of stop valve required when the diameter was in excess of 2 in. Diaphragm valve seats or disks of rubber or composition liable to fail due to deterioration or vulcanizing with hot water were prohibited for water relief valves of Pars. H-44 and H-93. In Pars. H-65 and H-118 the value of 30 psi for the operating pressure, which fixed the limit of pressure of 60 psi for the hydrostatic test, was changed to 40 psi. The limit of 6 per cent in the last paragraphs of the sections on excess pressure was changed to 10 psi. In Pars. H-64 and H-117 the point of action of the water relief valves was made not lower than the bottom of the water glass. In Par. H-70 on fusion welds, the fusion-welded joints might be considered as fully supported in figuring the pitch of stay bolts except when the welded joint was in a flat surface.

This Code ended with an index of $4\frac{1}{4}$ pages.

SECTION V, CODE FOR MINIATURE BOILERS

The 1937 edition of the Code for Miniature Boilers was produced under the direction of the same subcommittee that produced the 1935 edition, C. E. Gorton,[1] chairman, James Part-

ington,[1] vice-chairman, E. R. Fish,[1] W. H. Furman,[1] G. A. Luck, C. O. Myers,[1] and C. W. Obert.[1]

Par. M-1 was enlarged to include the requirements for forced-circulation boilers and those with no fixed water line.

Par. M-13 was enlarged to prohibit the introduction of feedwater through openings or connections used for water column, the water glass gage, or the gage cock when the boiler was under pressure. In closed systems the water might be introduced through any openings when not under pressure. When the boiler had no pressure parts other than the steam generating coil or tubing, the stamping required by Par. M-20 might be placed on a separate nonferrous plate not less than 3 × 4 in. in size irremovably attached to the front of the boiler casing.

In the appendix, Fig. MA-2 was deleted and replaced by the former Fig. MA-3, and the old Figs. MA-4 and MA-5 became Figs. MA-3 and MA-4. In Par. MA-3, Full-Section Tension-Test Specimen, and the last sentence of the paragraph on Reduced-Section Tension-Test Specimen were deleted. In Par. MA-4, Tension Tests, the test results were altered to care for the deletion of the full-section tension-test specimen. This section of the Code had an index of two pages.

SECTION VI, RULES FOR INSPECTION (SUGGESTED)

The 1937 edition of Rules for Inspection was published in the same volume that contained Sections I and II and the Appendix of the Code. It had been prepared under the direction of the same committee which prepared the 1935 edition, J. A. Collins, chairman, S. H. Barnum, L. E. Connelly, William Furguson, C. E. Gorton,[1] F. W. Herendeen, and James Partington.[1]

In this section of 61 numbered paragraphs, there were no revisions.

SECTION VII, SUGGESTED RULES FOR CARE OF POWER BOILERS

The 1937 edition of Suggested Rules for Care of Power Boilers was prepared under the direction of the same committee that prepared the 1935 edition with the exception of the late W. H. Larkin: F. W. Gibson, chairman, V. M. Frost[1], J. R. Gill, G. A. Hunter, H. J. Kerr, S. T. Powell, C. W. Rice, H. F. Scott, N. Stahl, and F. G. Staub.

This section of 88 pages with 341 numbered paragraphs, Pars. C-1 to C-341, and an appendix of 27 paragraphs, Pars. CA-1 to CA-27, was unchanged in the new printing.

SECTION VIII, CODE FOR UNFIRED PRESSURE VESSELS

The 1937 edition of the Code for Unfired Pressure Vessels was prepared under the direction of the same committee that prepared the 1935 edition: E. R. Fish,[1] chairman, C. A. Adams,[1] W. H. Boehm[1], C. E. Bronson, R. E. Cecil,[1] Paul Discrens, A. W. Limont, Jr., H. S. Smith, and D. B. Wesstrom.

The preamble contained an addition to division (*c*) to include vessels containing air, the compression of which served only as a cushion or in an air-lift pumping system among the excluded vessels mentioned.

The wording of Par. U-1 was simplified and contained the new limitation to the meaning of volume when used for a single vessel that had a jacket. A new paragraph of this section limited the Code for Unfired Pressure Vessels to those in which all of the materials used and the type of constructions complied with the Code rules.

Par. U-2 contained an additional paragraph which defined unfired vessels in which steam for power or heat was generated for external use as unfired steam boilers which might be constructed under the appropriate classification according to the Code for Unfired Pressure Vessels, but equipped with safety devices required by the Power Boiler Code applicable to the service of the particular installation.

Par. U-3 was shortened to require safety valves of the spring-loaded type to be ASME standard valves bearing the Code symbol, thereby demanding much that was called for by the section on safety valves in Section I of the Code, including the use of the test report. Par. U-4 of the 1935 edition was not needed under these conditions and the new Par. U-4 provided for the effect of static head.

The added paragraph Par. U-12(*c*) provided that cast, forged, or rolled parts of small size ordinarily carried in stock, for which mill reports or certificates were not customarily furnished, might be used when it had been demonstrated that they were suitable for the purpose intended. Specification S-28 was added to the materials available for use under the Code for riveted and seamless construction until data could be submitted to demonstrate its weldability.

Par. U-13(*c*) was altered to limit the use of S-26 steel to definite conditions and Par. U-13(*e*), permitted the use of S-32 for Electric-Resistance-Welded Steel and Openhearth Iron for tubes. Par. U-13(*g*) permitted the use of S-13 cast iron under six given conditions. E. R. Fish, chairman of the Subcommittee on Unfired Pressure Vessels, had brought the inclusion of such vessels of cast iron to the attention of the Boiler Code Committee for a number of years, during which time these conditions for its approval were developed.

Par. U-19 on the maximum allowable pressure was enlarged and made more definite.

Pars. U-20(*c*) and (*d*) on nonferrous tubes and pipes were added to the Code with Table U-4 for the values of the allowable stresses at different temperatures from 150 F to 450 F for six different specifications of nonferrous tubes and pipes.

A paragraph added to Par. U-32 permitted welding of abutting edges of the shell plates when the butt strap of a welded joint did not extend the full length of the shell plates.

In the formula for dished heads of Par. U-36(*a*) a term *E*, the efficiency of the weakest joint in the welds used in building up the head, and the values of the stress *S* were fixed by Table U-3 when temperatures above 700 F were to be used in the vessel. Pars. U-36(*d*) and (*h*) required the amount of reinforcement of heads to be that required by Par. 59(*g*), and Par. U-36(*f*) provided that when a dished head with a reverse flange had pressure on the concave side it should meet the requirements of Par. U-51 for deformation.

Changes were made in the description of the constant C = 30 of the formula for flat heads, U-39, while for C = 75 the statement was simply revised.

Pars. U-40 to U-51, on braced and stayed surfaces and Par. U-52 on calking were unchanged, but Par. U-53 on manholes and handholes for air vessels and Par. U-54 for air vessels requiring access for inspection in places subject to corrosion were rewritten and made more complete than in the 1935 edition.

An initial statement in Par. U-59(*a*) on unreinforced openings gave the limitations and use of sections (*a*), (*b*), (*c*), and (*d*) of that group for shells in which there were tube holes or other unreinforced openings. The openings were limited to shells of 8 in. or more in diameter or where the thickness did not exceed one-fifth of the diameter and the largest hole did not exceed sixth-tenths of the diameter of the shell.

Par. U-59(*o*) was enlarged to cover the use of the inserted nozzle, shown in Fig. U-7 as described in Par. P-268, Section I.

Par. U-66, Stamping, was enlarged to make the intent and meaning more definite and to cover each vessel of those structures containing more than one pressure vessel.

The rules regarding test plates, Par. U-68(*a*), were made more definite by slight additions to two paragraphs, but Par. U-68(*i*) on nondestructive tests was altered extensively as oc-

curred to the similar section Par. P-102(*i*) as described in Section I with the increase of the possible thickness for x-ray examination to $5^1/_4$ in.

Slight changes in Par. U-69 made the intent more explicit, and a paragraph on soundness was added as was done in Par. U-70. The qualifications of a welding process and the testing of the welding operator according to requirements of AWS appeared in the Appendix of Section VIII as Pars. UA-30 to UA-46 and were called for in Par. U-69(*b*), Test Welds and Par. U-69(*c*), Test Specimens. These additions were made in a similar section of Par. U-70 and the same substitution of radiographic tests of the test plates for the nick-bend test was permitted as had been given in Par. U-69 in the 1935 edition.

Par. U-71(*b*), material for manhole frames, nozzles, and other pressure connections, was changed to permit use of castings, and reference was made to Par. U-12(*c*) allowing the use of certain small cast, rolled, or forged materials. Par. U-72, Preparation for Welding, contained only one small addition. The addition to Par. U-72(*j*) excluded any process of welding by which proper fusion and penetration were obtained without impurities from the requirements for double-welded butt joints of that paragraph.

Changes for clarity were made to Par. U-73 on joints, and in Par. U-76 on stress relieving, the new limitation of $1^1/_4$ in. for thickness appeared in Par. U-69 above which stress relieving was required by Par. U-69.

The Rules for Forge Welding, Pars. U-80 to U-90, were not changed and the Rules for Brazing, Pars. U-91 to U-96, contained an addition to Par. U-95 which permitted the welding of unbrazed edges when the brazed joint did not extend the full length of the sheet and the weld was not greater than four times the thickness of the steel plate.

No changes were made in the section on Enameled Vessels, Pars. U-97 to U-105, nor to those on rules for Electric-Resistant Butt Welding, Pars. U-110 to U-114, and Rules for Vessels Subject to External Pressures, Pars. U-120 to U-138.

The Rules for Containers for Gases and Liquids at Temperatures from 10 to —150 F were found in Pars. U-140 to U-144. The preamble limited the rules to vessels containing noncorrosive gases and liquids and to temperature not lower than —150 F or higher than that of the atmosphere. They did not apply to vessels in which thermal stresses imposed by conditions of operations would be an important factor. Par. U-140, Seamless Containers, prohibited their use where there was danger of having holes made in the shell and called for S-18 material of three grades and required the Charpy impact test. Par. U-140(*c*), Design, referred to Fig. U-25 of typical containers for liquefaction of solid carbon dioxide and gave the value of the maximum allowable stresses for the three grades of material. Par. U-141 placed these containers under all of the requirements of Section VIII prescribed welding under Par. U-68 with impact tests of base metal and welds, and Par. U-141 required the same number of such tests as those of Par. U-68 for tensile tests.

Par. U-142, Impact Properties and Tests, gave the conditions, methods, and desired results for such tests. Par. U-143 called for the safety devices of Par. U-2 but excluded those Pars. U-3 to U-10. Par. U-144 provided for stamping. The rules were given on three pages of the Code.

The Appendix contained the Standard Practice for Hydrostatic Tests to Determine Maximum Allowable Working Pressure, Pars. UA-1 to UA-9; Examples of Methods of Computations of Openings in Shells, Pars. UA-10 to UA-15; and Rules for Bolted Flanged Connections, Pars. UA-16 to UA-29. These were unchanged from those of 1935 with the same figures, charts, and tables, except that in Par. UA-29 paragraph (*e*) was added for ring flanges and hubbed flanges with reference to (new) Figs. UA-2(*f*) and UA-2(*g*).

The new extensive section on rules for qualification of welding process and testing of welding operators comprised Pars. UA-30 to UA-46 as has been mentioned in the discussion of the 1937 edition of Section I.

The appendix closed with the forms of the manufacturers' partial data report and manufacturers' data report for unfired pressure vessels.

An index of seven pages was included in this Section VIII of the Code of a total of 135 pages.

Engineering Developments of Rubber 1951-1952

(*Continued from page 638*)

120 "Physical Properties of Natural and Synthetic Rubber Materials at Low Temperatures," by J. Z. Lichtman and C. K. Chatten, *Analytical Chemistry*, vol. 24, May, 1952, pp. 812–817.

121 "A Study of Various Low Temperature Test Procedures," by A. F. Helin and B. G. Labbe, *India Rubber World*, vol. 126, May, 1952, pp. 227–231; June, 1952, pp. 365–368.

122 "Spectrometric Determination of Refractive Index at Low Temperatures," by R. H. Wiley and R. R. Garrett, *Journal of Polymer Sciences*, vol. 7, August, 1951, pp. 121–131.

123 "A Test for Crystallization in Rubbers," by J. R. Beatty, *India Rubber World*, vol. 125, January, 1952, pp. 438–439.

124 "A Low-Temperature Flexibility Tester," by M. A. Pollack, *Rubber Age*, vol. 69, September, 1951, pp. 713–717.

125 "Modulus and Relaxation of Elastomers in Torsion at Low Temperatures," by M. Mooney and W. E. Wolstenholme, *Industrial and Engineering Chemistry*, vol. 44, February, 1952, pp. 335–342.

126 "The T-R (Temperature-Retraction) Test for Characterizing the Low-Temperature Behavior of Elastomeric Compositions," by J. F. Svetlik and L. R. Sperberg, *Rubber Chemistry and Technology*, vol. 25, January–March, 1952, pp. 140–151.

127 "Butadiene Polymers for Low Temperature Service," by R. E. Morris, J. W. Hollister, and F. L. Shew, *Industrial and Engineering Chemistry*, vol. 43, November, 1951, pp. 2496–2500.

128 "Plasticizers for GR-S Gasket Stocks to Be Used at Low Temperatures," by R. E. Morris and J. W. Hollister, *Rubber Age*, vol. 70, November, 1951, pp. 195–203.

129 "Ozone Crack Depth Analysis for Rubber," by J. S. Rugg, *Analytical Chemistry*, vol. 24, May, 1952, pp. 818–821.

130 "A Study of the Factors Affecting the Weathering of Rubberlike Materials," by E. W. Ford and L. V. Cooper, *India Rubber World*, vol. 124, September, 1951, pp. 696–698, 701, vol. 125; October, 1951, pp. 55–60.

131 "Static Exposure Testing of Automotive Compounds," by H. A. Winkelman, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 841–849.

132 "Ozone and Sunlight Effect on Aging of Carbon Black Vulcanizates," by G. E. Popp and Lynn Harbison, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 837–840.

133 "Ozone Resistance of Neoprene Vulcanizates; Effect of Compounding Ingredients," by D. C. Thompson, R. H. Baker, and R. W. Brownlow, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 850–856.

134 "The Frosting of Rubber, Its Occurrence, Cause, Prevention and Nature," by J. T. Beaudry, *Rubber Age*, vol. 69, July, 1951, pp. 429–432.

135 "Cracking of Rubber and GR-S in Ozone; Effects of Temperature and Elongation," by G. R. Cuthbertson and D. D. Dunnom, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 834–837.

136 "Ozone Deterioration of Elastomeric Materials," by A. R. Allison and I. J. Stanley, *Analytical Chemistry*, vol. 24, April, 1952, pp. 630–635.

137 "Ozone in Los Angeles and Surrounding Areas," by A. W. Bartel and J. W. Temple, *Industrial and Engineering Chemistry*, vol. 44, April, 1952, pp. 857–861.

138 "The Application of Rubber in the Quantitative Determination of Ozone," by C. E. Bradley and A. J. Haagen-Smit, *Rubber Chemistry and Technology*, vol. 24, October–December, 1951, pp. 750–755.

139 "Atmospheric Ozone—A Simple Approximate Method of Measurement," by J. Crabtree and R. H. Erickson, *India Rubber World*, vol. 125, March, 1952, pp. 719–720.

BRIEFING THE RECORD

Abstracts and Comments Based on Current Periodicals and Events

J. J. Jaklitsch, Jr., *Technical Editor*

MATERIAL for these pages is assembled from numerous sources and aims to cover a broad range of subject matter. While few quotation marks are used, passages that are directly quoted are obvious from the context, and credit to original sources is given.

Industrial Co-Operation

NEARLY every industry—producers and users of materials of all kinds—pays an annual toll of millions of dollars to corrosion, marine growth, and affiliated enemies of raw and manufactured products. To help combat these corrosion and fouling problems the ocean has been put to work by the International Nickel Company, Inc., through its Kure Beach Program, for the general study of corrosion by salt water, salt air, and of the effects produced by marine organisms on metals, wood, and other materials.

This project includes the marine testing station at Harbor Island, near Wrightsville Beach, N. C., and the sea spray and atmospheric studies at Kure Beach. (Mechanical Engineering, July, 1952, pages 581–584.)

A distinguishing feature of this research project is the fact that it is designed primarily to increase knowledge of how to solve corrosion problems rather than as a revenue-producing enterprise. The benefits derived from the results accrue not only to Inco, but to the many manufacturers and consumers of materials who have a similar problem.

Since the establishment of the Kure Beach Project in 1935, these research facilities have been conducted on an entirely co-operative basis in which producers of sometimes competitive products have united in the free exchange of information on the ravages of corrosion and marine growth. Specimens from more than 100 companies have been studied.

To supplement these studies, Inco sponsors technical meetings several times a year at Wrightsville Beach, to which are invited personnel from all types of companies and covering a wide variety of industries. Here, at the Beach, these groups band together and through well-planned technical programs and clinics, air their problems for possible answers and, in addition, receive a wealth of information about corrosion and fouling.

For example, at the Eighth Annual Engineers Group Meeting held at Wrightsville Beach, June 3–5, 1953, one technical session was devoted to a review of some fundamentals of corrosion and covered galvanic corrosion, stray-current corrosion, and cathodic protection. Another session, and of prime importance to mechanical engineers, was concerned with the effects of velocity on corrosion and erosion in sea water of pumps, piping, valves, and new alloys—90–10 versus 70–30 cupronickel—with particular regard to behavior under environmental conditions, galvanic effects, effects of water pollution, and heat-transfer characteristics.

Deterioration by marine organisms and its control were also discussed at one of the sessions. Covered were the fouling of hulls; fouling and sliming of intake tunnels; piping, and heat-transfer equipment; attack by ship worms and other marine borers; and attack by fungi or dry rot.

High lights of all these sessions are the open discussions which follow the presentation of the main subject. Here is where all industry profits. Any questions posed by the participants on a specific problem receive consideration and, if possible, are answered by the speakers or guests. This, on occasion, has led to many excellent round-table discussions at which new ideas, better methods, and helpful suggestions are interchanged between both allied and competitive companies.

In addition, during the course of the meeting, the guests inspect the facilities both at Harbor Island and Kure Beach where they can actually see at firsthand how Inco carries out this testing program.

It is indeed a unique example of an all-industry co-operative effort.

Air-Pollution Study

AIR pollution along the United States-Canada international boundary line in the Detroit River area has been the subject of much discussion and complaints of residents living on either side of the international boundary line. Vessels plying the international waters were especially subject to criticism as their emission rates far exceeded the permissible limits as established by the ordinances of the cities of Detroit and Windsor. The Detroit River is a narrow body of water and, as the vessels are in close proximity to land, the citizens on either side of the boundary, depending upon the wind direction, were subjected to the smoke nuisance.

How to Obtain Further Information on "Briefing the Record" Items

MATERIAL for this section is abstracted from: (1) technical magazines; (2) news stories and releases of manufacturers, Government agencies, and other institutions; and (3) ASME technical papers not preprinted for meetings. Abstracts of ASME preprints will be found in the "ASME Technical Digest" section.

For the texts from which the abstracts of the "Briefing the Record" section are prepared, the reader is referred to the original sources: i.e. (1) The technical magazine mentioned in the abstract, which is on file in the Engineering Societies Library, 29 West 39th St., New York 18, N. Y., and other libraries. (2) The manufacturer, Government agency, or other institution referred to in the abstract. (3) The Engineering Societies Library for ASME papers not preprinted for meetings. Only the original manuscripts of these papers are available. Photostat copies may be purchased from the Library at usual rates, 40 cents per page.

The citizens on the Canadian side also objected to the air pollutants which were discharged in the United States and carried by the wind into Canada. Conversely, residents of the United States complained of the pollutants originating in Canada and carried by the wind into the United States. Thus it may be seen that the air-pollution problem in the Detroit-Windsor area is truly international in character.

The governments of the United States and Canada recognized this international problem by signing on Jan. 12, 1949, a Reference requiring their respective governments to study air pollution and its effects on the communities in the Detroit River area.

A report entitled, "Report of Results of Sampling the Atmosphere in the Detroit River Area During 1951," presents the Reference, a résumé of the origin and responsibilities of the International Joint Commission, the Technical Advisory Board, and the results of the environmental studies conducted on the United States side. The report was prepared by George O. Clayton, chairman, United States Section, Technical Advisory Board, International Joint Commission, and Paul M. Giever, chief engineer.

According to this report, actual field work was started on the United States side in the spring of 1951.

Twenty-eight census tracts were selected and paired, with each pair having inhabitants of similar socioeconomic status but a difference in degree of air pollution.

High-volume air instruments were selected as the particulate matter samplers. A sampler was placed in each of the areas on a power pole ten feet from the ground. Maintenance of the samplers was considered to be excessively high as the average time of operation for a motor was approximately 1000 hr.

Analytical procedures were developed for the elements and compounds collected. Recovery of sample from filter papers, however, was rather difficult and expensive.

During the sampling period May 7 to June 17, 1951, 33 to 42 samples were collected at 31 sampling stations located in the 28 census areas.

Most samples for total particulate matter were within the range of 100 to 350 micrograms per cubic meter of air with only a few less than 50 or more than 750 micrograms per cubic meter of air.

Highest median values for particulate matter loading were with one exception located close to the Detroit River in the south and southwest sections of Detroit, the single exception being a station near the community of Hamtramck which is located in the center of Detroit. Lowest median values were found in residential areas removed from local sources of air pollution.

The difference between the high and low median values for the 31 stations was 357.1 and 121.6 micrograms per cubic meter of air, respectively, a spread of 235.5 micrograms per cubic meter of air. A difference of nearly 300 micrograms per cubic meter of air existed between maximum and minimum values at each station, thus indicating a greater variation at any one location than between the stations.

Daily variations in loading at each station followed the trend of the average for all stations very closely, with those stations having the highest median values also showing the greatest deviation from the average.

The total particulates of the high-volume air samples after being weighed were analyzed spectrographically to identify quantitatively and semiqualitatively, 24 elements. Aluminum, iron, silicon, and calcium were the most predominant, having median values of 2.7, 2.4, 2.4, and 2.1 micrograms per cubic meter of air, respectively. The median values for magnesium, nickel, copper, zinc, molybdenum, manganese, chromium, barium, lead, tin, titanium, cadmium, and vanadium ranged from 0.002 to 0.7 microgram per cubic meter of air. Antimony, cobalt, and beryllium each had "absent" median values.

Little correlation was found to exist between total particulate matter and the elements aluminum, iron, and silicon. No relationship was found to exist between total weight and calcium. The relationship between total particulates and the other elements tested was inconsistent.

The relationship between median total weight and fluorides, chlorides, sulphates, if any, was obscure.

The dust counts made using the standard light-field technique showed a median count of 0.7 MPPcf. There was no correlation between dust counts and total weight.

Particle-sizing of samples taken by the impinger method and thermal precipitator showed remarkably close agreement. The median size of the dust collected in the general atmosphere was 0.94 micron.

On those days when pollution loading was below average, the prevailing wind appeared to be generally from the northeast and for the days when the concentration was above average, the predominating wind was from the southwest. Southerly and southwesterly air flow is generally a warmer air mass advancing over cooler ground with a resulting increase in stability near the surface and less turbulence. Cold-air masses usually accompany north or northeasterly flow and are generally heated by the surface as they move south with a consequent steepening of the lapse rate close to the surface resulting in greater turbulent mixing and less air pollution.

Precipitation occurred whenever minimum particulate concentrations occurred, but no correlation was found to exist between the quantity of rainfall and concentration of pollution as both high and low values were obtained with small amounts of rainfall. Rain showers rather than heavy rains were most often reported for days when low atmospheric concentrations were measured. It was not established, however, whether the rainfall or accompanying atmospheric instability was the dominant factor in low concentration of pollution.

Correlation was made between total particulate matter, wind speed, wind direction, and sources of pollution at each of the 31 sampling stations. Maps were prepared graphically presenting these data and indicated that when sources of heavy pollution were within a one-mile radius of the sampling location they influenced the weight of the sample obtained. Treating the data in this manner also indicated sources of pollution which included not only industrial operations but heavily traveled streets, schoolyards, and residential activities.

Mobile units containing Thomas Autometers were used advantageously to record sulphur dioxide. Good agreement in results was found in the two similar units operated. They were located at representative points in the study area.

A study of the relationship of total particulate matter to sulphur dioxide showed that no correlation could be found between these two contaminants. It may therefore be concluded that sulphur dioxide is not an index to the total atmospheric pollution in the Detroit area.

Approximately 70 per cent of the sulphur-dioxide readings were less than 0.10 part per million. Seasonal grouping of the months—January, February, and March; October, November, and December—showed the highest average sulphur dioxide concentrations and more marked diurnal peaks. The diurnal variations were also more marked in areas of high pollution. Maximum sulphur-dioxide averages occurred on Sunday with the PHS Autometer and on Friday, Saturday, and Sunday with the Detroit unit, indicating lack of correlation with weekly cycling industries.

From the data presented it may be concluded that no one contaminant can be isolated to be used as an index to total pollution.

Deltic Oil Engine

AN 18-cylinder, 2500-hp oil engine, having a triangulated cylinder arrangement with opposed pistons, and operating on a two-stroke cycle, is now in large-scale production at the works of D. Napier and Son, Ltd., Acton, London, W.3, England, according to *The Overseas Engineer*, June, 1953. Known as the Deltic because of the triangular form, this new engine has been developed for the Royal Navy on behalf of Napier's parent company, English Electric.

While specifically intended for marine work, the Deltic has many other applications—wherever high power for minimum weight and space is a prime requirement. By the arrangement of cylinders in the form of a triangle the technical merits of efficiency and mechanical simplicity which are inherent in the opposed-piston design are exploited to the full.

Design data for the engine are as follows: Bore, 5.125 in., stroke, 7.25 in.; maximum bhp 2500 at 2000 rpm; continuous rating 1875 bhp at 1700 rpm; cylinder swept volume, 5384 cu in.; effective volume, 5300 cu in. Piston speed at 2000 rpm is 2416 fpm; bmep at maximum power is 91.9 psi. Dry weight of bare engine is 8725 lb (3.5 lb per hp). With reverse gear, weight is 10,500 lb (4.2 lb per hp). Length (with reverse gear), 10 ft, 11 in., width 6 ft, 2.5 in., height 7 ft, 1 in.

The components of the engine are small enough to permit the use of aero engine materials and manufacturing techniques; for example, fully hardened crankshafts, thin-wall lead-bronzed bearings, and case-hardened and ground gears which at the designed ratings give extremely long life. All parts of the engine, both individual components and major assemblies such as the reverse gear, phasing gear, scavenge blower, and so on, are fully interchangeable.

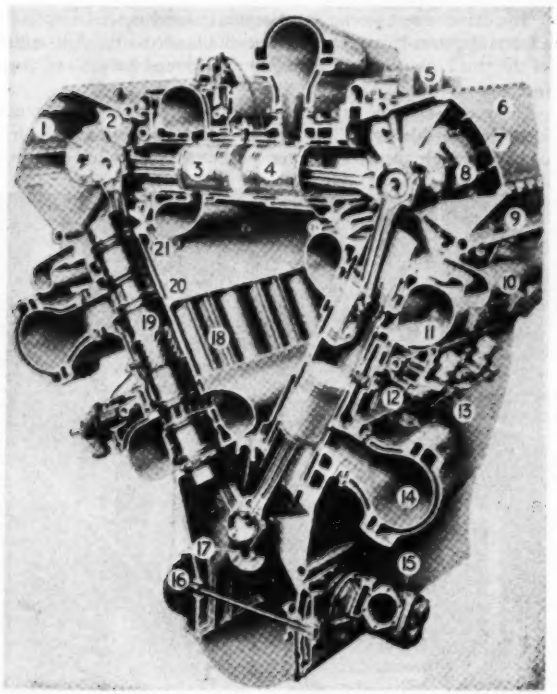

FIG. 1 SECTION ACROSS NO. 5 BANK OF CYLINDERS OF THE DELTIC OIL ENGINE

(1, BC crankshaft; 2, BC crankcase; 3, inlet piston; 4, exhaust piston; 5, crankcase breather; 6, AB crankcase; 7, AB crankshaft; 8, main bearing cap; 9, crankcase tie bolt; 10, drain oil manifold; 11, air-inlet gallery; 12, A camshaft; 13, fuel pump; 14, exhaust manifold; 15, coolant pump; 16, pump drive; 17, CA crankshaft; 18, block tie bolts; 19, liner; 20, C block; 21, blower drive.)

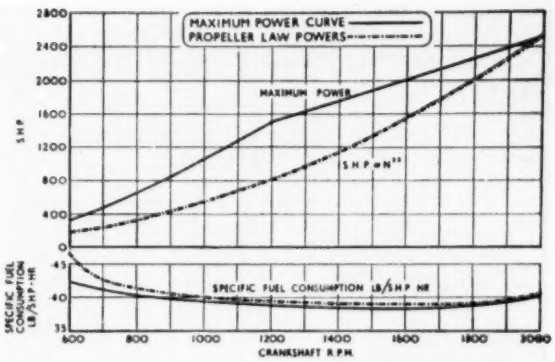

FIG. 2 PERFORMANCE CURVES OF THE 2500-HP DELTIC OIL ENGINE DEVELOPED FOR THE BRITISH ROYAL NAVY

The outstanding feature of the engine is, of course, the disposition of the cylinders in cross section in the form of an equilateral triangle. With this arrangement the lower crankshaft must rotate in the opposite sense from the other two.

Two important technical advantages arise directly from this geometrical layout, *The Overseas Engineer* notes. First, there results automatically a phase angle difference of 20 deg between exhaust and inlet crankshafts; this phase displacement, with the exhaust crankshaft leading, facilitates the use of an extremely efficient porting layout for scavenging and cylinder charging. Second, each crankpin carries one inlet and one exhaust piston so that the loading on each crankpin, and thereafter the power transmitted through each crankshaft, are identical.

When this triangular arrangement is extended through the length of the six-throw crankshafts, each shaft having a normal cylinder firing order (1, 5, 3, 4, 2, 6), the resultant 18-cylinder engine has equal firing intervals of 20 deg, thus giving extreme smoothness in running.

The triangulated unit which constitutes the main body of the engine is built up from three identical cast-aluminum six-cylinder blocks forming the sides and three cast-aluminum crankcases at the corners, the two upper cases being similar, but the lower one being deepened in section to carry engine bearers and to provide effective oil drainage.

The whole structure is held together by high-tensile-steel through-bolts extending from each crankcase through the cylinder block to the other crankcase. These bolts carry all combustion loads, the cylinder blocks remaining in compression. This triangular unit, therefore, is said to be extremely strong and inherently of great rigidity.

Steel Production

THE greatest monthly steel production in history—totaling 10,168,000 net tons of ingots and steel for castings—was poured from the steelmaking furnaces in this country during March, according to *Steel Facts*, June, 1953. Never before had the 10-million-ton mark been reached in steel production.

The March output is shown on Fig. 3 in comparison with the production of 555 other months since the start of 1907.

With the record high output during March, the production of the first quarter was higher than ever before in any quarter, 28,999,000 tons.

Also included in the chart is the April steel output—totaling

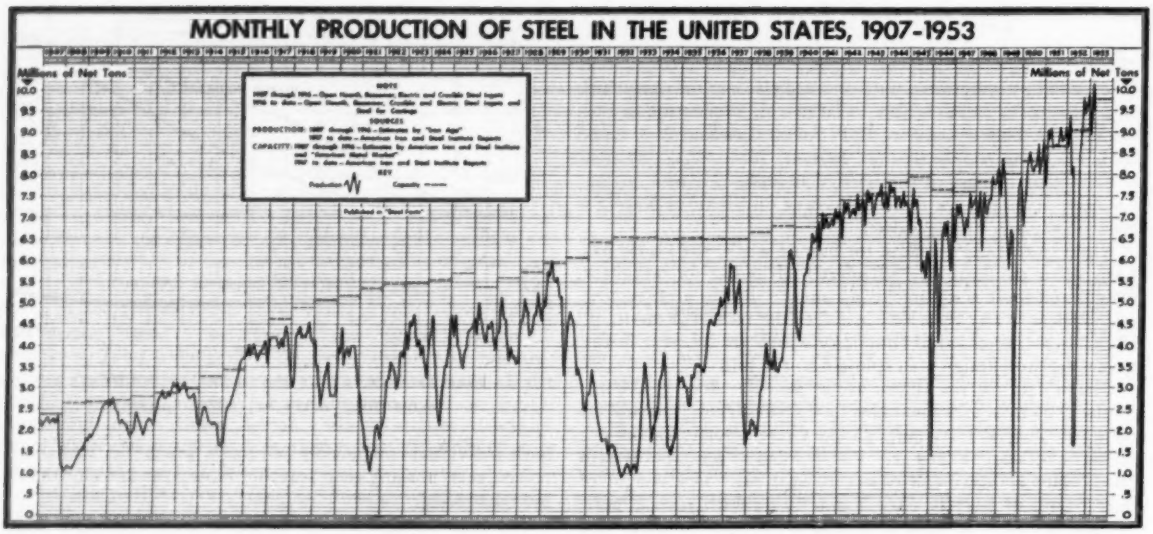

FIG. 3 OUTPUT OF STEEL IN THE UNITED STATES MONTH BY MONTH, THROUGH WARTIME AND PEACETIME FOR 556 MONTHS UP TO MAY 1, 1953

9,545,000 net tons of ingots and steel for castings. It was the highest ever attained in that month. The output of the first four months of this year was 38,543,839 tons, a record high production which exceeded the output of the first four months last year by 3.3 million tons or 9.5 per cent, reflecting increased capacity.

The April production was 1,553,000 tons higher than the output of the same month in 1952, an increase of 19 per cent.

A record for any month was attained by the shipments of finished steel products during March at 7,436,919 net tons. The shipments during the first three months of this year set a quarterly record of 21,057,464 tons. That total was 1.2 million tons, or 6 per cent higher than in the first quarter of 1952. Among the products showing substantial increases over the shipments of the first quarter of 1952 were rails, hot-rolled and cold-finished bars, oil-country goods, mechanical tubing, electrolytic tin plate, sheets, and semifinished forms of steel.

Shipments of stainless-steel products increased several times as rapidly as carbon-steel products, the total of 169,222 tons in the first quarter being 24 per cent higher than one year earlier. Shipments of other alloy products meanwhile rose 11 per cent to 1,615,287 tons in the quarter.

Experimental Fork Truck

A FORK-LIFT truck, still in the development stage—called the Clark X-70—was unveiled by Clark Equipment Company, Battle Creek, Mich., at the recent 5th National Materials Handling Exposition, held in Philadelphia, Pa. Borrowing the "experimental model" technique used by the large automobile manufacturers to obtain customer reaction on new styling and mechanical innovations, the new truck features a fully automatic drive, a streamlined body and lighter frame, adjustable automotive-type seat, counterbalanced hood, and greater accessibility for maintenance and repair work.

While the streamlined body is attractive to the eye, it is also functional. The sides of the frame between the front and rear wheels, for example, are turned under and form an oil reservoir, or sump, on one side of the truck and a fuel tank on the other. This arrangement makes for a lighter, sturdier frame, which also provides exceptional accessibility to the engine compartment, the company states.

The driver's seat in the experimental model is the completely adjustable, automotive type and extends across the full width of the truck, thus affording maximum driver-freedom and comfort.

Clear access to the driver's seat from both sides of the truck is made possible by a floor board and cross aisle totally free of any encumbrances. The dual pendant-type brake pedals are

FIG. 4 ARTIST'S SKETCH OF EXPERIMENTAL FORK-LIFT TRUCK

hung from the cowl, and since the X-70 has an automatic transmission, there are no gear-shift levers or clutch pedal.

Known as the "Hydratork Drive," this automatic transmission, newly engineered by Clark, was also shown for the first time. It combines the power-multiplying torque-converter widely used in the passenger-car field adapted for industrial trucks, with a greatly simplified forward-reverse transmission. With this drive, only three simple controls are necessary: An accelerator, brake, and a forward-reverse lever on the steering column. To change direction of travel, the driver simply flicks the lever with one finger to either forward or reverse, without stopping.

For convenient accessibility to the engine, the X-70 has a counterbalanced hood hinged at the rear counterweight. The hood can be taken off by removing one bolt on either side. Lifting the hood actuates a light which provides illumination for maintenance work.

The streamlined counterweight is fastened to the frame by two bolts that can be removed without using an overhead hoist to hold the counterweight. This arrangement permits quick and simple removal of the counterweight, a feature specially desirable in stevedoring work. In that connection, provision is made on the counterweight for "ships-sling eyes." The counterweight has a built-in taillight that can also function as a stop light or a warning flasher light. In line with the growing application of radio communication as a means of utilizing fork-lift trucks to maximum capacity, the X-70 features built-in two-way radio equipment.

To establish a positive means for setting up a truck service and maintenance schedule, the X-70 is provided with an engine-hour meter which indicates truck operating time.

Extra-large rear steer wheels make the truck easier to operate and also contribute to longer tire life.

Planetary Geared Rollwelder

A NEW welding machine, developed at Solar Aircraft Company, San Diego, Calif., is cutting manufacturing and equipment costs through an innovation in resistance-welding technique.

The rollwelder is used to make automatically circular seam welds on J47 jet-engine exhaust-cone assemblies. Designed and built at a cost of $14,000, the machine joins the afterburner fuel manifolds to the engine-exhaust cone. One rollwelder replaces seven spotwelders—costing a total of $49,000—which were formerly required to do the same work.

With the special rollwelder, cycle time for the welding operation has been cut almost 80 per cent, from four hours to 45 min. One man operates the unit, where formerly seven operators were needed. Handling of the parts has also been significantly reduced.

In operation, the Solar rollwelder makes a 3-in-diam seam weld around the support bosses of the fuel manifold. Usually in resistance welding the electrodes remain stationary while the part being welded is moved. In the Solar unit, the seam-welder head, which is the moving member and constitutes the upper electrode, automatically rolls around a circular path while the work remains stationary

Another unusual technical aspect of the welding machine is that the moving upper electrode carries approximately 14,000 amp through a $^1/_2$-in-diam shaft and a floating joint.

The lower electrode of the unit is essentially an air-operated clamping fixture. After positioning the work and closing the lower electrode, the welding operation is completely automatic. Welding speed is adjustable from 8 to 48 ipm.

Although the new Solar unit—known as the planetary geared rollwelder—is a highly specialized machine, it is also extremely versatile. In less than 30 min the special tooling can be replaced by conventional tooling, making the machine a standard universal (circumferential or longitudinal) seam welder.

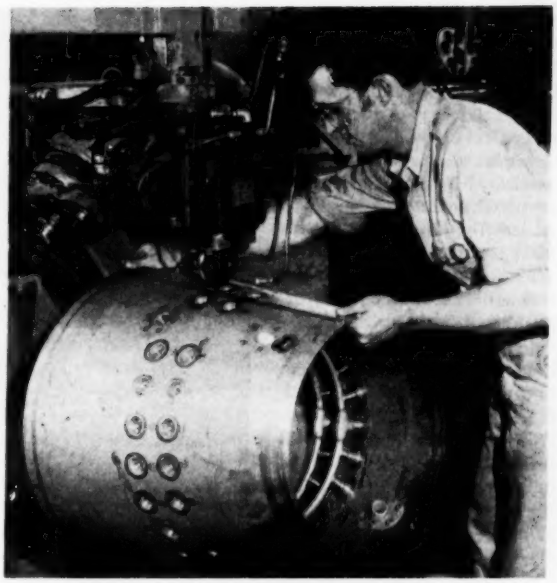

FIG. 5 PLANETARY GEARED ROLLWELDER IN OPERATION, MAKING CIRCULAR SEAM WELDS TO ATTACH THE AFTERBURNER FUEL MANIFOLD ON A J47 JET-ENGINE EXHAUST-CONE ASSEMBLY

Versatility has also been stressed in the design of the special tooling. The size of the upper electrode's circular path may be varied from zero to a 6-in. radius, making the machine adaptable to a wide range of circular welding operations.

Designed by Solar, the machine was built by Taylor Winfield Corporation. The basic unit is a medium series, 36-in. throat, 150-kva transformer, low-inertia-head seam-welding machine.

Topsy and Godiva

SOME new developments in methods of assembling critical amounts of radioactive materials were revealed recently by the Los Alamos Scientific Laboratory, which is operated for the Atomic Energy Commission by the University of California. These developments are based on two machines known to the Laboratory staff as "Topsy" and "Godiva."

To study the properties of fissionable materials the Laboratory has constructed several remote-control devices for determining the critical masses of various substances—that is, for establishing the masses and configurations of active material which must be assembled to produce self-sustaining chain reactions (i.e., miniature reactors). These assembly machines are much simpler and less expensive to operate than other types of nuclear reactors because they use enriched fissionable material in an isolated area observed by television and operate at modest power, and it is possible to eliminate the elaborate protective shielding and cooling systems which are usually associated with permanent reactors.

The Los Alamos machines are also used to study the effects of foreign materials on critical and subcritical assemblies. The effect of foreign substances is important because even such

things as water or wood can affect the criticality of a fissionable material. For example, a human hand placed near a mass of material that is just barely subcritical can, under the right circumstances, reflect enough neutrons back into the material so that its rate of fission will exceed the level required to make the material reach a critical state. The mass of material will then become supercritical, or chain-reacting.

In the early days of the Laboratory, until 1946, test assemblies were made by hand. However, because of the hazards involved, remote control is now used on new assemblies and on all work in which an assembly is deliberately brought to critical. Hand operations are limited to assemblies previously tested and to studies in which it is known that only safely subcritical quantities of fissionable material are involved.

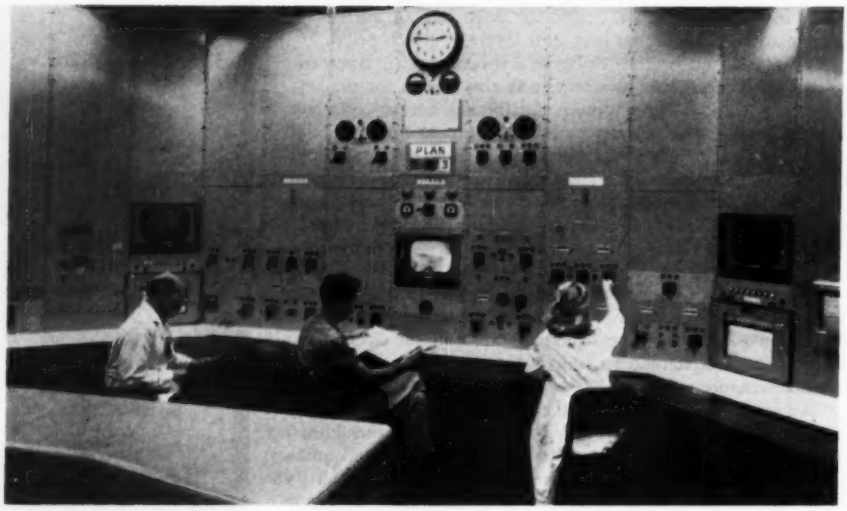

FIG. 7 REMOTE-CONTROL PANEL FOR THE LOS ALAMOS CRITICAL ASSEMBLY MACHINES

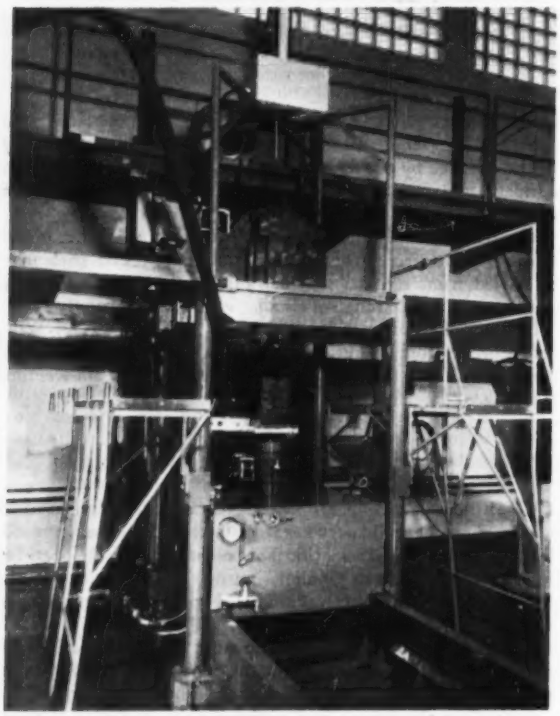

FIG. 6 TOPSY, ONE OF THE REMOTELY CONTROLLED CRITICAL-ASSEMBLY MACHINES CONSTRUCTED AND OPERATED AT THE LOS ALAMOS SCIENTIFIC LABORATORY

(The machine includes a hydraulic lift mounted on a cart which can be moved along the track in the foreground. A rectangular block of neutron-reflecting material located on top of the hydraulic cylinder is adapted to hold part of a critical mass. The other part is held inside the housing located directly above the cylinder—this housing is also constructed of neutron-reflecting material. A chain-reacting assembly is made by bringing the two masses of fissionable material together and then inserting normal uranium control rods into openings in the reflector—the entire operation is controlled and watched on a TV screen from the safety of a control building a quarter of a mile away.)

One of the canyon sites of the Laboratory was constructed for the critical assembly work. The main buildings at this site are assembly laboratories and a control building. The control building is about a quarter of a mile from the assembly buildings. The distance between the buildings was chosen on the basis that it would afford adequate protection against any nuclear reaction which might occur in the assembly laboratory. Under such circumstances the control building would be safe from immediate radiation effects because of the rapid attenuation of radiation with distance. The distance would also allow time for control personnel to abandon the site before radioactive dust could be blown from the assembly building to the control building. Each assembly building is also known locally as a "Kiva," the name of a Pueblo Indian ceremonial assembly hall.

Topsy was given its name because of the manner in which it "just grew" from an idea. The name of Godiva also has a logical basis. This machine, or reactor, is designed to measure the amount of fissionable material that would constitute a bare critical mass. Most reactors have reflectors to bounce escaping neutrons back into the fissionable material. Godiva has none, and therefore is known as an unclad reactor.

From the standpoint of physical structure, Topsy and Godiva are somewhat different. Topsy includes a vertical hydraulic ram which is mounted on a movable cart and which is designed to hold a portion of a critical mass. The cart and ram can be moved on a track to a position directly beneath an overhead housing which contains the other part of the mass. The ram is raised by remote control until the two parts are brought together—the assembly is completed by the insertion of normal uranium control rods into the neutron reflector surrounding the fissionable material. The normal uranium boosts the neutron reflection effect, sending more escaping neutrons back into the fissionable material. This arrangement differs from that used in most other nuclear reactors, where control rods made of some nonfissionable material are inserted into the reactors to absorb neutrons and thus control or stop chain reactions. Topsy is equipped with various auxiliaries which permit operation at critical (the condition existing when a

chain reaction is just self-sustaining) and the insertion of independent neutron sources by remote control.

Godiva, on the other hand, consists of three pieces of fissionable material which can be assembled to form a critical mass. In the assembly operation, two portions of the active material, located on either side of a fixed central section, are moved vertically toward the central portion. The upper movable section is mounted on a pneumatic cylinder, and the lower section on a hydraulic ram. After the three parts have been brought together, criticality is approached by inserting fissionable material control rods into openings in the assembly. Unlike Topsy, Godiva's control rods are used to adjust the amount of fissionable material in the assembly. Provision is made for placing a neutron source at the surface of the assembly and for adding active material to the outer surface of the mass. Neutron sources are frequently used to initiate chain reactions in active material—when the reactions become self-sustaining, the sources may be removed.

Like other critical assemblies in the Laboratory, Topsy and Godiva are equipped with independent safety devices. Three neutron monitors, spaced at various positions around each machine, are hooked up so that any one of them can actuate the safety devices and cause the machine to "scram," with the result that the fissionable mass is rapidly disassembled and made subcritical. The safety mechanisms are designed for positive operation even if there should be a power failure, so gravity, compressed air, and spring devices are used instead of electric motors to operate the mechanisms.

One of the interesting developments in this work which has been described previously is the use of television to watch the assembly operation from the control building. A TV camera is directed at one of the assembly machines in the Kiva, and the image is picked up on a receiver mounted in the control room. This enables the control operators to watch for mechanical difficulties which might interfere with the assembly but which would not be otherwise apparent from the control station.

Heat-Sensitive Cable

A HEAT-SENSITIVE cable that will withstand 2000-F temperatures and signal an alarm if touched by flame at any point has been developed by Edison Research Laboratory, West Orange, N. J., as the basis of a new fire-detection system of wide possible application.

The cable, it was announced, is being integrated into a new fire-detection system by the Edison Instrument Division, whose thermocouple-type system is now in widest use by the aircraft industry.

The new system will consist of lengths of the new cable strung around the area to be protected. In aircraft application the cable would be strung around the engine nacelle or other areas. If any part of the cable is touched by flame, warning is flashed so that remedial action can be taken either automatically or manually to minimize damage. Until now fire-detection systems have consisted of a series of point detectors spaced around the area to be protected; until the flame came in close contact with one of the points no alarm was activated. Since the entire length of the new cable is sensitive, the coverage offered can be much more complete.

Normal high temperatures or even repeated exposure to fire will not hamper the cable's ability to respond accurately and quickly to flames, it was reported.

Success came after three years of investigation of existing equipment and of fundamental scientific phenomena. This inquiry soon resolved that a new material was needed; that this material must be a good semiconductor impervious to the highest degree of heat so that it could re-alarm as often as necessary without decomposing.

Once having decided upon the merits of a semiconductor type of heat-sensitive device, the concept of having an outer sheath serving the dual function of electrode and protective covering and a concentric center wire separated from the outside sheath by an annular ring of semiconductive material was arrived at. The material of the outside sheath and the center wire is a high nickel alloy. The semiconductor employed here was developed so that the characteristics of resistivity, stability, and uniformity could be controlled on a production basis. The semiconductor finally developed and in the form used is unique in having a steep negative temperature coefficient of resistivity combined with great stability so that long-time immersions of the heat-sensitive cable under extremely high ambient-temperature conditions does not provoke a drift in the electrical resistance of the material.

The problems of reducing the basic concept of a coaxial type of continuously heat-sensitive cable to a practical production procedure were many. Choice of outer sheath and center wire was influenced by factors such as resistivity, melting points, tensile strength, ductility, work-hardening and heat-treatment factors, resistance to corrosion, heat conductivity, and many others. The semiconductors used were chosen after many exhaustive tests, and experiments revealed that factors such as impurity effects, melting points, and chemical stability were of prime importance.

The semiconductor finally developed is of such stable nature both chemically and thermally that even relatively large amounts of impurities and exposures to extreme temperatures provoke no serious change in the calibrated resistance value.

Future prospects for applications and usage for the heat-

FIG. 8 DEMONSTRATION OF HOW HEAT-SENSITIVE CABLE WORKS
(The cable, looped around a gasoline-soaked wooden box in a fish bowl, extends to an instrument panel, and through the panel to a tank of fire extinguisher. As the flame hits the cable the alarm is sounded and the extinguisher is discharged automatically. In actual application the circuit is just as simple, with no more instrumentation needed than that shown on the panel at right.)

sensitive cable appear bright. It may be used for the detection and consequent extinguishment of fires in homes and industry. As a heat-sensing element in the form of a sensitive bulb, it may be used to indicate and control industrial heat processes. It may be applied to the field of bearing alarm as an overheat detector and in other similar devices where overheat is a symptom of pending mechanical breakdown. The ability of this device to withstand temperatures normally destructive to other heat-sensing devices coupled with the feature of continuous sensitivity over its length has opened fields in jet-aircraft instrumentation for heat and fire control.

Wood-Waste Panels

AN AUTOMATIC 200-ton, 131-ft-long machine for the continuous production of all-wood panels from wood waste and other fiber wastes, was announced recently by Bartrev Ltd., to the technical press at the Hotel Pierre, New York, N. Y.

Called the Bartrev press, the developers said that the new machine should have the same effect on the wood industry as the continuous production of paper, plate glass, strip steel, and aluminum had in their respective industries.

The first press, which is protected by world-wide patents, is now in continuous operation on a three-shift, seven-day-week basis near London, England. This plant is producing at the rate of 30,000,000 sq ft annually.

Using over 50 tons daily of normally wasted wood materials, the press is turning out a continuous 4-ft wood panel at speeds up to 30 fpm. With the exception of employing a "dry process," the press resembles a modern papermaking machine, permitting control of the weight and thickness of the product, which leaves the machine as an endless sheet.

Production area of a Bartrev plant requires less than 10,000 sq ft of floor space, according to the company.

Starting with wood shavings, trim, and other forms of cellulose as its basic raw material, the Bartrev process begins its cycle of conversion. The raw material is first reduced to uniform fragments in preparation for further processing.

Automatically weighed, the raw material is combined with mall quantities—4 to 8 per cent—of inexpensive resins. Treated material is now evenly distributed by a special feeder on to an endless 50-in-wide band of stainless steel. The steel band carries the uniform carpet of material through a radiofrequency unit for preheating.

Emerging from the radiofrequency heater, the carpet of wood particles enters the heated pressure zone of the press, where the resin is set and the actual formation of the board takes place. An opposing upper steel band meets the carpet of wood particles, and pressure exerted by six hydraulic units gradually eliminates warp—causing air pockets to form a flat uniform panel. The finished board is then delivered in a continuous flow at speeds up to 30 fpm. Finally, the strip is trimmed and cut into desired lengths by a traveling cutoff saw.

The resulting wood panel is said to combine lightweight and high strength with an attractive smooth surface.

Some other advantages claimed for the panel are as follows:

1 It is low in cost, selling for 3 to 9 cents per sq ft at mill level.

2 All kinds of wood materials and other fibrous wastes can

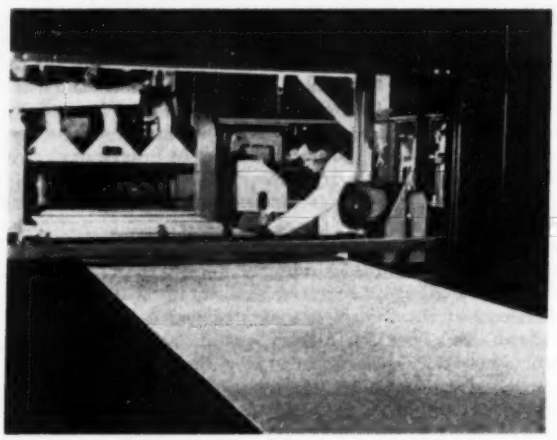

FIG. 9 DELIVERY END OF THE BARTREV PRESS SHOWS ENDLESS 4-FT-WIDE, 1/4-IN-THICK STRIP EMERGING AT A SPEED OF 20 FPM

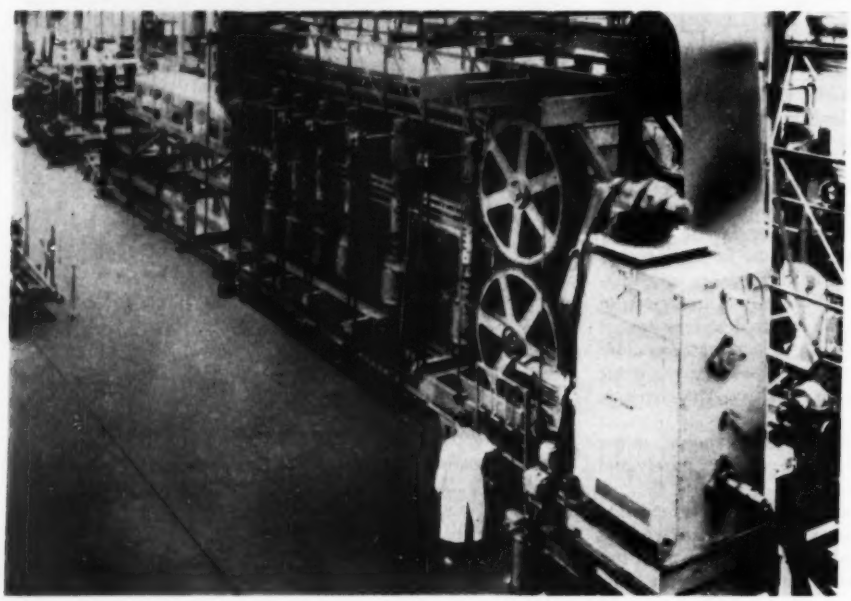

FIG. 10 AUTOMATIC 130-FT, 200-TON BARTREV PRESS FOR CONVERTING WOOD WASTE AND OTHER FIBROUS MATERIALS INTO WOOD PANELS

(View shows pressure zone where board of controlled density and thickness is actually formed.)

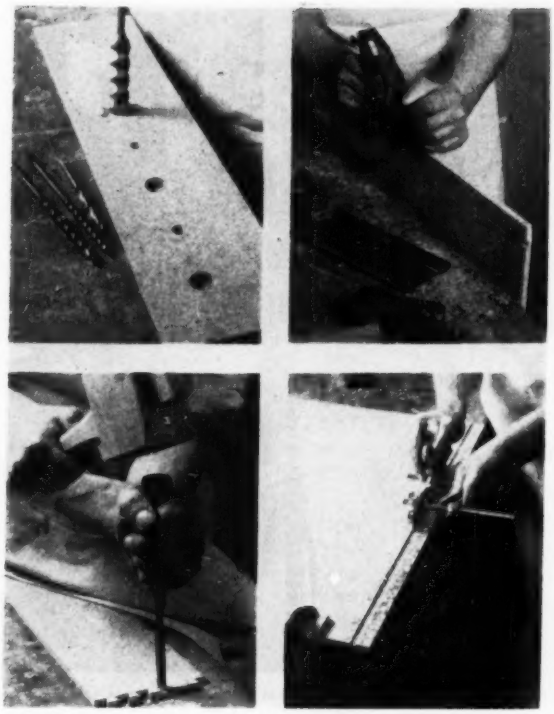

FIG. 11 AS SHOWN, BARTREV BOARD CAN BE DRILLED, PLANED, CHISELED, AND RABBETED WITH ORDINARY WOODWORKING TOOLS

be employed in production of the board. Both wet and dry resins can be used.

3 It is fixed in only one dimension—maximum width—which is set by the width of the press. The length is continuous. The panel density and thicknesses, ranging from $^3/_{16}$ in. to $^3/_4$ in., are automatically controlled.

4 It is flat and warp-resistant. Bartrev panels are also uniform in quality because all phases of the continuous production are controlled and automatic.

5 A low-cost core material for wood veneers and plastic laminates like Formica can be made.

6 Decorative papers, textiles, metal foils, laminates, and the like, can be bonded directly to the board during the manufacturing process.

7 Properly treated, the board can be made fire-retardant and pest-resistant.

8 The material can be sawed, cut, bent, screwed, nailed, drilled, and jointed with ordinary woodworking tools.

It was also announced that several of the presses are now under construction for sale in the United States and Canada through the company's representatives, Aries Fiberboard Corporation, New York, N. Y. Price of the Bartrev press is about $615,000 at the company's plant in England.

U. S. Railroads

THE situation, problems, and prospects of the railroads of the United States were appraised by William T. Faricy, president of the Association of American Railroads, before the Eighth Pan American Railway Congress, held in Washington, D. C., and Atlantic City, N. J., June 12–25, 1953. During the week of June 21, meetings were held in Atlantic City by the member roads of the Association of American Railroads and the American Shortline Railroad Association, the AAR Mechanical and Purchases and Stores Divisions and Electrical Division, and the Railway Supply Manufacturers Association. In addition, 200 companies participated and displayed about $20,000,000 of equipment at the exhibit held in Convention Hall, including a 2400-ft track exhibit.

In his paper Mr. Faricy set the background of the railroad situation today by calling attention to a series of paradoxes involved: More than 600 operating railroads in keen competition with each other, yet partners too, in a continent-wide service; privately owned, operated, and supported, yet competing with other transportation agencies partially or wholly supported by public expense; notwithstanding this varied and extensive competition, they are regulated as a monopoly; and to cap these paradoxes they pay large taxes to the Federal, State, and local governments, yet produce service at an average ton-mile cost much lower than any other form of transportation offering a general service. But, notwithstanding these seemingly handicapping paradoxes, the railroads, he said, remain the foundation of the nation's transportation, moving more tons more miles than all other means combined.

Mr. Faricy explained that the present situation requires performance for defense purposes and at the same time the rehabilitation of power and car fleets in the face of heavy demand for materials for defense plants and war goods. He also quoted a summary of the satisfactory performance by the Defense Transportation Administration of the Federal Government. This, he said, leaves no doubt of the confidence in the railroads to meet their obligations of service to domestic needs and defense requirements.

In discussing some of the major railroad problems, Mr. Faricy pointed out that since 1921, the first full year of private operation of U. S. railroads after the government operation established during World War I, the use of railroads has increased from less than 3000 tons per year to more than 4000 tons per year for each person of a rapidly increasing population. In the same period, hourly wages have increased 165 per cent, the average price of materials and supplies has gone up 120 per cent, and the taxes have more than doubled.

To keep the railroads modern and efficient, they have spent for plant and rolling stock $600 million a year since 1921. Since the end of World War II, the average has exceeded $1 billion and in the two years 1951 and 1952, the average exceeded $1.4 billion per year.

A serious problem, Mr. Faricy said, is the failure of the industry in the 1940's and 1950's to earn enough to restore its general credit where additional equity securities or even general mortgage bonds can be sold in important amounts. The rate of return on net investments in railroad property has averaged approximately $3^1/_2$ per cent since the end of the second World War and in no such year has the return reached $4^1/_2$ per cent. Except for the purchase of rolling stock with deferred payments, most railroad improvements had to be financed directly out of earnings.

The low rate of return, Mr. Faricy pointed out, is not due to lack of traffic, nor is it due to inefficiency. The level of traffic has been high and transportation service per freight-train hour has trebled in 30 years, doubled in 20 years, and increased nearly 50 per cent in the past 10 years. The investment ratio is not at fault as this compares favorably with previous years. The outstanding securities are about $^3/_4$ of the depreciated investment. The low ratio of return, the author said, is due primarily to the failure of railroad rates to keep pace with rising unit costs. Since 1946 the rate increases have totaled about 79 per cent, but the average revenue per ton per mile has increased

only 47 per cent since 1939. Some of the railroad difficulties are due to competitive transportation agencies which, in addition to being subsidized, are able to be selective in the kind of traffic handled, while the railroads maintain a true common carrier service handling all goods offered.

According to Mr. Faricy, the prospects of the railroads are favorable notwithstanding the enumerated handicaps. The favorable factors are the inherent advantages of the train of cars on tracks; the vast continent requiring land transportation in great abundance and variety which the railroads are better able to supply; the increasing efficiency of operations; and the rapid technological advance as a result of long and intense research. In addition, he said, there is the factor of favorable public opinion and the recognition by public authorities of the realities of the competitive situation which requires that the railroads be relieved of services, such as local passenger-train service, that drain the resources of the railroads because the public uses other means of transportation.

And, finally, Mr. Faricy asserted that the future of the railroads depends upon the achievement of adequate earnings for the railroads—for without earnings, or the prospect of earnings, there can be no continued investment in the new and improved devices which research develops, and without continued investment there can be no great further improvement in capacity or service.

Ceramics Research

ONE of the most extensive laboratories of its type in the atomic-energy program is said to be the new Ceramics Department of the Oak Ridge National Laboratory, which Union Carbide and Carbon Corporation operates for the Atomic Energy Commission at Oak Ridge, Tenn. Because of the breadth and diversity of the investigations and studies being undertaken in its research programs it is rapidly becoming recognized as the center of ceramic research as applied to nuclear-energy activities in this country.

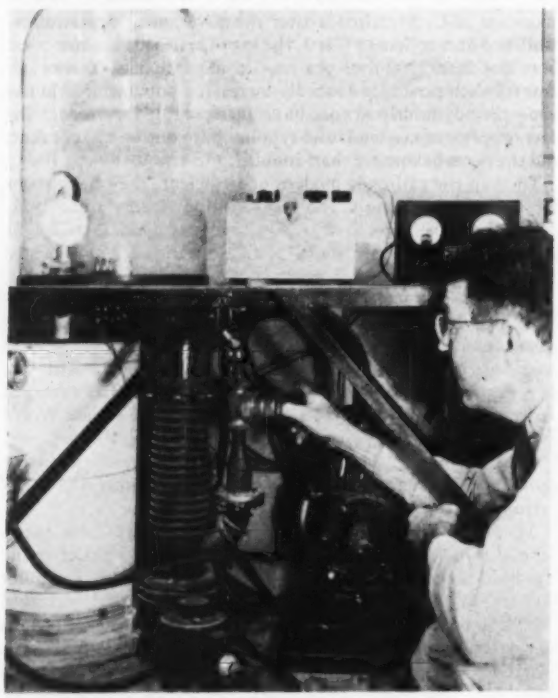

FIG. 12 VACUUM DILATOMETER IS USED FOR DETERMINATION OF THERMAL CONDUCTIVITY OF CERAMIC MATERIALS IN CONTROLLED ATMOSPHERES UP TO 2200 F

FIG. 13 APPLICATION OF CERAMIC COATINGS BY SPRAYING THE FINELY POWDERED CERAMIC THROUGH A FLAME ONTO THE PREPARED SURFACE OF THE MATERIAL TO BE COATED IS AMONG THE FABRICATION TECHNIQUES UNDER INVESTIGATION

One of the outstanding problems in the development of nuclear power is to find suitable material for the construction of nuclear reactors or atomic furnaces, particularly since many of the service requirements are highly unusual. Reactors operating at temperatures over 800 F may prove to be the most economical system for nuclear-power production. Most metals are limited to service below 1500 F. However, ceramic materials that can withstand elevated temperatures offer a possible solution to the problem. In particular, they show promise for use in low-cost "power-package" reactors. Therefore the development of a new ceramic material or adaptation of a previously known one for high-temperature work where metals or alloys are unsuitable is important to the nation's nuclear-energy program.

"Cermets"—combinations of ceramic materials and metals with the best qualities of both—are possible "white hopes" of reactor-materials research. But Cermet studies are only a part of the Oak Ridge National Laboratory ceramic-research program. Other important features include a study of oxide, boride, and nitride ceramics as structural materials; techniques for the application of ceramic coatings to materials used in reactors; and evaluation of the effect of radiation damage on ceramic materials.

In addition to its program of fundamental and applied research projects that occupy about 85 per cent of the time of the Ceramics Department people, the group performs services for other research departments at Oak Ridge National Laboratory. The members do consulting work, aid in the design of specialized apparatus, and lend personal assistance whenever it is needed in investigations under way in the other departments.

ASME TECHNICAL DIGEST

Substance in Brief of Papers Presented at ASME Meetings

Oil and Gas Power

The Production and Utilization of Residual Fuels, by R. E. Albright and C. W. Hoffman, Socony-Vacuum Oil Company, Inc., Research and Development Department, Paulsboro, N. J., C. E. Habermann, Marine Sales Department, New York, N. Y., and W. F. Hergrueter, Technical Service Department, Brooklyn, N. Y. 1953 ASME Oil and Gas Power Conference paper No. **53—OGP-1** (mimeographed).

THE nature and characteristics of residual fuel oils have become of increasing interest in recent years largely because of the trend to use heavy fuels in marine diesels and in railroad and industrial gas-turbine engines. This trend is based on the possibility of large savings in fuel costs and extends also into the field of industrial diesel engines.

This paper clarifies the types of products classified as residual fuels, provides specific information on present-day product characteristics, and indicates the changes in product characteristics which may be expected as a result of changes in refining operations.

Detailed information is also presented on some of the problems which may be expected in the utilization of heavy fuels with particular emphasis on diesel applications.

Although many detailed conclusions can be drawn from the data presented in the paper, the broader aspects of residual-fuel utilization are considered to be of primary importance and may be summarized as follows:

1 Residual fuel can be expected to cover a wide range of characteristics depending on the crude oil used and the type of processing employed.

2 The trend in refinery processing is toward the production of less residual material, further concentrating the less desirable components into this product. However, as a result of world demand for more and more petroleum products of all types, more crude oil will be run and therefore no reduction in the total amount of residual fuel is anticipated for some years to come.

3 The use of residual-type fuels in marine and industrial diesel-engine applications offers the possibilities of large savings in fuel costs. There are, however, a number of problems which will require the joint efforts of the engine and accessory-equipment builders, operators, and the petroleum industry, before the most efficient utilization can be achieved.

Valve-Gear Fundamentals for the Large-Engine Designer, by J. A. Newton and C. H. Allen, Thompson Products, Inc., Cleveland, Ohio. 1953 ASME Oil and Gas Power Conference paper No. **53—OGP-2** (mimeographed; to be published in Trans. ASME).

THE poppet valves of any internal-combustion engine, large or small, receive specialized attention from designers as they frequently are the factor limiting the interval between engine shutdowns for overhaul. Although valves receive the brunt of the criticism, frequently the cause of the difficulty involves other parts associated with the valve system. For this reason, valve manufacturers have found it advisable to become intimately associated with design testing and research of the components found in conventional valve-gear systems.

The purpose of this paper is to bring before the members of the large-engine industry fundamental information which may be of help in simplifying their valve-gear-design problems. Covered are valve proportioning, valve face angle, valve dimensioning, carbon scraper, valve guide, valve materials, valve rotation, insert seat, rocker arm, valve springs, and valve motion.

Crank Webs Including Arc-Web Design, by S. W. Newell, Jun. ASME, The Union Diesel Engine Company, Oakland, Calif. 1953 ASME Oil and Gas Power Conference paper No. **53—OGP-3** (mimeographed).

A principal objective of this paper is to present some descriptive data on certain types of crankshafts. It is possible that here may be found a few thought-provoking suggestions and developments. The paper presents some practical knowledge based more on shop experience than on intricate mathematical hypotheses. It shows how a desirable design objective was developed through an intimate

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knowledge of manufacturing techniques, problems, and capabilities.

Fundamentally, any crankshaft is composed of one or more elemental cranks or throws. Each crank consists of a crank arm, one end of which is rigidly fastened at right angles to the rotating shaft or axis; while the other end has projecting from it at right angles and parallel to the axis, the crankpin. In modern practice and terminology each crank usually consists of structural components known as crank webs; portions of rotating shaft or axis form main bearing journals; crankpin is usually supported by a crank web on each side. Projecting crankpins are used in some special applications. All components continue to perform their usual functions; their forms and names are changed only to make them efficient or to more clearly portray their functions.

The Turned Manifold: Supercharging Without a Blower, by Helmuth W. Engleman, University of Wisconsin, Madison, Wis. 1953 ASME Oil and Gas Power Conference paper No. **53—OGP-4** (mimeographed).

THE object of the present study was the development of a clear basic concept which would afford a direct and rational approach to the optimum manifold design. The major interest was in the manifold proper, rather than in long external piping. Because four-stroke-cycle scavenging has been less thoroughly explored than that of two-stroke-cycle engines, and because four-stroke-cycle engines are more sensitive to intake conditions than to exhaust conditions, the bulk of the work was concentrated upon the four-stroke-cycle intake system.

The project was begun with a number of ideas of how "ram supercharge" or "manifold tuning" might be accomplished, and other ideas were taken from the literature in the field. Only the final line of approach is discussed.

The following conclusions are drawn from the results of this study:

1 It is possible to achieve a very substantial supercharge in a four-stroke-cycle engine by proper proportioning of the intake pipes. The condition required is that the resonant frequency of the Helmholtz resonator consisting of the intake pipe and the cylinder with the piston in its mid position, be approximately twice the operating speed at which the peak supercharging effect is desired. The supercharging effect is maintained over a wide speed range.

2 It is possible to increase the power output of an engine of the four-stroke-cycle type by tuning the exhaust system in substantially the same fashion. The ratio of resonant frequency of the cylinder and pipe resonator to operating speed range has yet to be determined.

3 The scavenging of blowerless two-stroke-cycle diesel engines is simple and rationally explained as a resonance phenomenon, considering the cylinder as a cavity resonated by the intake and exhaust pipes in parallel. The same approach also serves to explain blowerless supercharging. The characteristics of a two-stroke-cycle engine which is to scavenge itself without a blower are dependent upon the intake pipe as well as the exhaust pipe.

Package Unit Converts Waste Engine-Exhaust Heat Into Dollars' Worth of Energy, by Robert C. Coblentz, Coblentz Equipment Company, Erie, Pa. 1953 ASME Oil and Gas Power Conference paper No. **53—OGP-5** (mimeographed).

AN immeasurable source of untapped power is the millions of dollars' worth of energy which constantly pours from engine-exhaust stacks.

Diesels have a good thermal efficiency and yet better than half the Btu's in the fuel used is rejected to the jacket water or goes up the stack. A high percentage of this heat is recoverable and can be utilized to advantage.

Waste-heat recovery in the form of steam, hot water, or air is boosting over-all Btu utilization. Today, through the development of a "packaged unit," recovery in the form of refrigeration is possible, thus broadening the field of waste-heat recovery application.

Such a packaged unit is now available to the diesel industry and not only does it operate automatically, but at almost zero cost. This complete packaged unit requires no field assembly. The unit provides an economical source of chilled water for a wide range of aplications by combining a waste-heat boiler and a hermetically sealed refrigeration system, all mounted on one base.

Availability of both heat and cold from normally waste-exhaust gases presents some interesting possibilities. By by-passing the refrigeration unit, the waste-heat boiler produces steam that can be used for all the purposes normally associated with this form of energy—process steam, space heating, humidification, hot water, or energy for a low-pressure turbine.

Use of the entire unit produces chilled water or refrigeration for processing, space cooling, dehumidification, and other such applications. Selective use of the unit's components provides a means for all-year-around air conditioning with almost zero operating cost.

The packaged unit described and illustrated in this paper is just one more tool in the hands of the engineer to utilize waste heat to advantage. With a little ingenuity this broadened range of possible methods of waste-heat utilization can be integrated into any number of installations.

Recaptured Btu's can be used to increase engine output and efficiency and for any requirement where chilled water can be used to advantage. The over-all thermal efficiencies that can be realized will not only amortize the cost of the additional equipment but will offer substantial savings.

Two and Four-Cycle Test Results of Medium-Speed Engines on Heavy Fuels, by Russell Pyles, Donald P. Cryor, Jun. ASME, and J. M. A. Van der Horst, Van der Horst Corporation of America, Olean, N. Y. 1953 ASME Oil and Gas Power Conference paper No. **53—OGP-6** (mimeographed).

THE increasing use of heavy fuels in the main propelling engines of ships has every indication of becoming general. It seems desirable from every angle that the auxiliary engines should be capable of operating on the same type of fuel, the paper states. This is dictated by fuel cost as well as convenience.

The technical problems associated with heavy fuels in large low-speed main engines have had some years of development and study with such success that there are now close to 500 motorships operating on boiler fuels. Problems of the low-speed auxiliary engine (under 500 rpm) may be similar to many of those problems encountered in the large low-speed main engines. However, as engine speeds increase, the old problems become more acute and new difficulties arise.

Higher-speed auxiliary engines will be demanded because of increased power requirements, lighter weight, and smaller space. Such engines operating on regular diesel fuels are already highly developed as typified by present-day locomotive and marine engines. The most desirable course would seem to be to adapt this type of engine to heavy fuels even though such a course involved development and design changes.

In conclusion, the paper states that in spite of the great number of difficulties involved in burning residual fuels in high-output medium-speed diesels, the attainment of the goal is worth the development effort. The work reviewed in this paper indicates that this can be accom-

plished by recognizing the problems and applying sound available engineering remedies.

One point seems definitely established—a standard engine, well developed and giving eminently satisfactory service on good No. 2 diesel fuels, cannot be expected to give equivalent performance nor reasonable maintenance when operating on residual fuels. To achieve this, the basic engine's accessories and certain parts must be retailored for the special conditions. This includes provision for burning the high viscosity and greatly contaminated fuels.

Preparation of the fuel requires further study as it is a major problem. Filtering alone is not sufficient nor is centrifuging combined with filtering. Possibly double centrifuging—the purified and clarifier—may suffice but there is a further step holding promise which is now under development, comprising water washing of the fuel. It may seem strange to add water to the fuel when every effort has been made to remove it. However, a great percentage of the corrosive metallic contaminants in the fuel are present as water-soluble salts. Mixing water with the fuel results in such salts going into solution. Subsequent centrifuging separates the contaminated-ash-bearing water from the fuel and gives the engine a more digestible diet.

In order to efficiently handle the higher viscosity fuel even at 200 F, the injection system requires changing in nozzle orifices, plunger diameter, and mechanical beefing up of cams, rollers, and pump parts to withstand higher injection pressures.

Improved fuel preparation will reduce ash and deposit tendencies in the exhaust system but Stellite or equivalent valve facing as well as valve rotation seem necessary.

The solution to abrasive and corrosive cylinder wear lies in the combination of the following:

1 High jacket-water temperatures to minimize condensation.

2 A cylinder wall material having extreme resistance to abrasion and corrosion such as chromium.

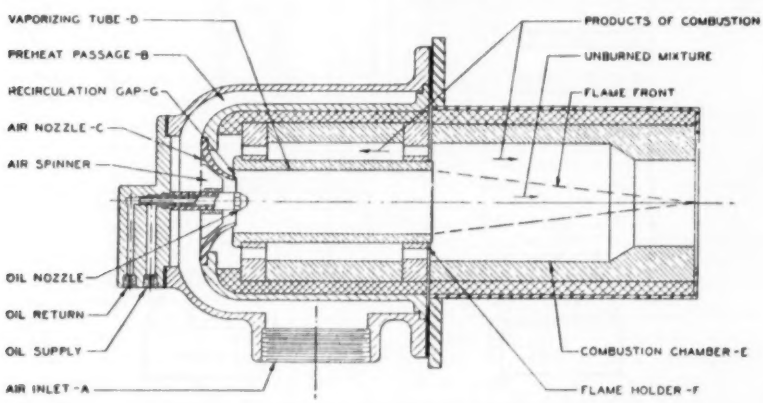
3 A lubricating oil of the high-additive type such as Military Specification 0-2104 Series I or II with extreme dispersant and corrosion-inhibiting qualities.

Fuels Technology

The Development of a Vaporizing Oil Burner, by J. A. Johnson and R. H. Eustis, Thermal Research & Engineering Corporation, Conshohocken, Pa. 1952 ASME Annual Meeting paper No. **52—A-171** (mimeographed).

A BURNER has been developed capable of burning distillate fuel oils within a duct at a high rate as a result of internal prevaporization of the fuel. This paper discusses the design, development, and performance of the vaporizing burner and indicates applications which have benefited by the characteristics of the burner.

Operation of the burner in principle is shown in the accompanying diagram. Air enters at point A and is conveyed to the air nozzle C. For ignition the air flow at the nozzle is reduced to a velocity of about 50 fps and enough fuel is introduced to produce a fuel-air ratio corresponding to about 50 per cent theoretical air. The air and fuel mix in the vaporizing tube D and travel to the enlargement F between D and the combustion chamber E. Ignition by spark occurs near the upstream end of the vaporizing tube, and the flame is carried down the tube to the enlargement F which serves as a flame holder. The rich starting mixture is required to produce a combustible mixture of fuel vapor and air in the vaporizing tube and at the flame holder when cold. The flame is not held in the vaporizing tube as the flame propagation velocity is less than the mixture velocity. The flame holder plate F is perforated with holes as shown and by reason of the low pressure at the throat of the air nozzle, a portion of the burning or burned gases at the point F is recirculated through the annular passage around the vaporizing tube to the inlet of this tube at the gap G. As the products recycle and the flame holder and vaporizing tube temperature increase, the liquid fuel accumulated on the tube wall is evaporated and the burner can be adjusted to the operating condition. The recycled products which enter the air stream at G provide the energy necessary to heat the vaporizing tube, the combustion air, and fuel spray. Burning, starting at the flame holder F, progresses inward to the center of the combustion tube at a downstream point. After the starting cycle which requires from a few seconds to 3 minutes depending on the burner size and ambient temperature, the flame is clear or nonluminous.



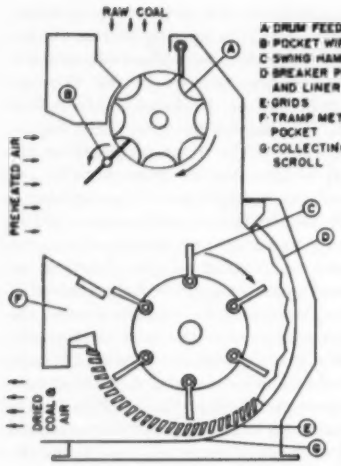
CROSS SECTION OF VAPORIZING OIL BURNER

The burner is regulated in a conventional manner by linking the fuel valve and air valve together. At the full output point the burner fuel-air mixture is usually set near the stoichiometric ratio. At low outputs the valves are generally adjusted to permit operation with excess air in order to maintain good breakup of the fuel spray and consequent vaporization. Completely automatic controls have been successfully installed in which the burner output is modulated according to the demand of a temperature or pressure-responsive element.

The vaporizing burner has been used to provide the same combustion characteristics as a gas burner. Successful applications have been made to heat equipment to save the space usually required for large combustion chambers, and to provide clean products of combustion at high temperatures and with controlled composition for heat exchange or chemical processes.

Mill Drying in Pulverizing High-Moisture Coals, by Wayne C. Rogers, Mem. ASME, Riley Stoker Corporation, Worcester, Mass. 1953 ASME Spring Meeting paper No. **53—S-47** (mimeographed).

SUCCESS in avoiding pulverizer capacity reduction due to high coal moisture depends upon more than supplying enough heat to evaporate the moisture.



ARRANGEMENT OF FEEDER AND CRUSHER-DRIER

Other factors, such as degree and duration of raw coal and air-mixture turbulence, and thermodynamic evaporative effects on total mixture flow, should be considered. This paper analyzes such factors and their effect upon performance using data obtained in both experimental and field investigations. It was found that the incorporation of a crusher-drier, of the type described in the paper, ahead of a coal pulverizer, plus the use of primary air at a high enough temperature to dry most of the surface moisture present in the coal, will afford substantially dry-coal operation of the pulverizer itself. Reduced milling capacity or even milling-equipment outages may thus be avoided when coals containing excessive amounts of surface moisture must be ground. The only excess grinding capacity required chargeable to the raw-coal surface moisture is that needed in grinding the extra coal burned to provide the heat ultimately used in evaporating it.

The Mechanism of Disintegration of Liquid Sheets, by J. Louis York, Mem. ASME, H. E. Stubbs, and M. R. Tek, University of Michigan, Ann Arbor, Mich. 1953 ASME Spring Meeting paper No. **53—S-40** (mimeographed; to be published in Trans. ASME).

THE disintegration of a plane sheet of liquid of finite thickness, moving tangentially relative to a surrounding fluid, is subjected to mathematical and experimental analysis. Instability and wave formation at the interface are established as the major factors in the breakup of the sheet of liquid into drops. An equation is derived relating four significant dimensionless groups, and a graphical presentation of the quantitative relationship among these groups is included in the paper.

The force balance between the interfacial tension and aerodynamic forces is the basic concept, and the criteria for stability and instability are determined from it. It is possible to predict the conditions for maximum instability, and therefore for the most rapid disintegration of the sheet, the paper states.

Short-exposure photographs of the actual disintegration of the sheet are included to support the analysis, and a prediction of drop size in the spray compares favorably with measurements by other methods.

Overfire-Air Installation at the Conners Creek Power Plant, by James W. Campbell, Mem. ASME, and Richard J. Travis, Jun. ASME, The Detroit Edison Company, Detroit, Mich. 1953 ASME Spring Meeting paper No. **53—S-21** (mimeographed).

THIS paper presents a report on the installation of overfire air on nine large stoker-fired steam generators. Purpose of the installation was to minimize smoke emission.

Solution of this smoke problem came as a result of the continued efforts of The Detroit Edison Company to reduce stack ejection of dust and smoke.

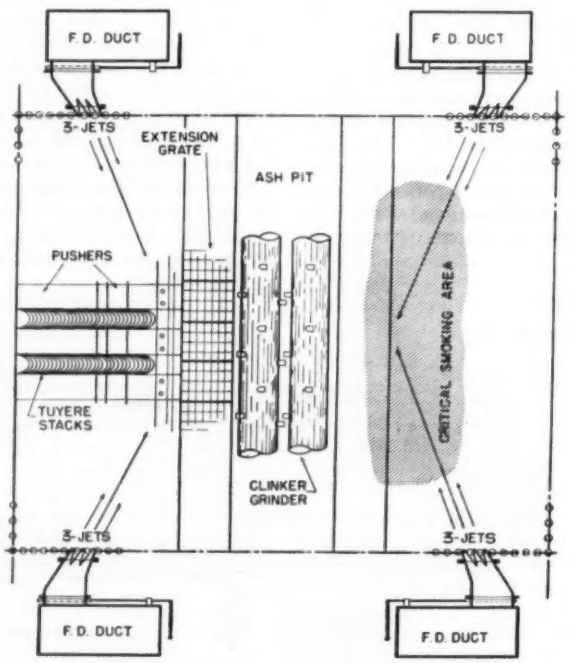
The overfire-air installation has been completed in nine of the eleven steam generators at the Conners Creek Power Plant of The Detroit Edison Company. The nine installations have been successful. The remaining two installations will be completed in 1953.

In conclusion, the paper states it is believed that the maximum benefits have not been fully realized from the overfire-air installation. Further tests are planned to determine the full benefits. Present indications are that total combustion air might be reduced without adversely affecting combustion conditions. A reduction in total combustion air and consequent reduction in heat loss to stack gases would result in an increased boiler-room efficiency.

Applied Mechanics

An Analytical Theory of the Creep Deformation of Materials, by Yoh-Han Pao, Jun. ASME, and Joseph Marin, Mem. ASME, The Pennsylvania State College, State College, Pa. 1953 ASME Applied Mechanics Division Conference paper No. **53—APM-3** (in type; to be published in the *Journal of Applied Mechanics*).

THIS paper reports on the formulation of an analytical theory of creep. The theory is proposed for an idealized material and may be applied to those ma-



PLAN VIEW OF FURNACE SHOWING LOCATION OF OVERFIRE-AIR JETS AND CRITICAL SMOKING AREA

terials whose behavior conforms to that of this ideal material. The theory takes into account the initial elastic strain, the transient creep strain, and the minimum-rate creep strain.

Unlike previous theories, this theory is capable of representing the simultaneous action of creep and creep recovery and may be used for conditions of varying as well as constant stresses. In this respect the theory is more general than those presented in the past.

The new theory is of particular importance in the design of many new military and domestic applications where high temperatures over short periods of time make the initial short-time creep strains of importance.

The Application of Limit Analysis to Punch-Indentation Problems, by R. T. Shield and D. C. Drucker, Mem. ASME, Brown University, Providence, R. I. 1953 ASME Applied Mechanics Division Conference paper No. **53—APM-21** (in type; to be published in the *Journal of Applied Mechanics*).

LIMIT analysis is applied to obtain upper and lower bounds for the punch pressure in the indentation of the plane surface of an elastic perfectly plastic material by a flat rigid punch. The two-dimensional flat punch and the three-dimensional flat square and rectangular punch problems are considered.

The analysis assumes Tresca's yield criterion of constant maximum shearing stress k, during plastic deformation. It is shown that the pressure required to produce indentation in the two-dimensional problem lies between $5k$ and $(2 + \pi)k$. The lower bound obtained for any rectangular punch is again $5k$ while the upper bound for a smooth punch lies between $5.71k$ for a square and $(2 + \pi)k$ for a very long rectangle.

A value of $5.36k$ is found for a ratio of length to breadth of 3. The limit pressure for a uniformly loaded area, as distinguished from an area loaded by a punch, is bracketed by $5k$ and $(2 + \pi)k$ when the area is convex.

On the Use of Singular Yield Conditions and Associated Flow Rules, by William Prager, Mem. ASME, Brown University, Providence, R. I. 1953 ASME Applied Mechanics Division Conference paper No. **53—APM-23** (in type; to be published in the *Journal of Applied Mechanics*).

IT is well known that the use of Tresca's yield condition frequently leads to a simpler system of equations for the stresses in a plastic solid than the use of the yield condition of Mises. However, in most cases where Tresca's yield condition has been used, the flow rule associated with the Mises condition has been retained. Following Koiter, it is shown that further simplification results from the use of the flow rule associated with the Tresca condition. The reason for this is discussed in connection with two examples concerning the finite enlargement of a circular hole in an infinite sheet of perfectly plastic or work-hardening material.

The second example is probably the first nontrivial case in which a problem of finite plastic deformation of a work-hardening material has been treated in closed form by the use of incremental stress-strain relations.

The Vibration of Rotating, Tapered-Twisted Beams, by G. W. Jarrett (deceased), and P. C. Warner, Jun. ASME, Westinghouse Electric Corporation, Lester, Pa. 1953 ASME Applied Mechanics Division Conference paper No. **53—APM-17** (in type; to be published in the *Journal of Applied Mechanics*).

THIS paper presents an extension of Myklestad's adaptation of the Holzer method of calculating natural frequencies and mode shapes of systems to the case of a tapered-twisted beam with certain elastic constraints. The details of the solution are so arranged that the bulk of the numerical calculations can be carried out by a technician with only a high-school mathematical background.

This extension makes possible the evaluation of the effect of rotation of a beam on a radial line, of certain elastic constraints such as the lashing wires, and shrouding used on turbine blades, and of coupling between the torsional and flexural vibrations. In this paper, however, the effects of coupling between the torsional and flexural vibrations are not considered. The basic differential equation is solved by the tabular method due to Holzer.

Influence of Viscous Effects on Impact Tubes, by C. W. Hurd, Electric Boat Company, Groton, Conn., K. P. Chesky, c/o Boston Naval Shipyard, Boston, Mass., and A. H. Shapiro, Mem. ASME, Massachusetts Institute of Technology, Cambridge, Mass. 1953 ASME Applied Mechanics Division Conference paper No. **53—APM-10** (in type; to be published in the *Journal of Applied Mechanics*).

EXPERIMENTS were conducted to determine the effect of viscosity on the pressure rise recorded by a blunt-nosed impact tube in incompressible flow. The results are presented in terms of the pressure coefficient ($C_p \equiv 2\Delta p/\rho V_\infty^2$) as a function of Reynolds number (Rey $\equiv V_\infty a/\nu$), where Δp is the excess of stagnation-point pressure over free-stream static pressure, V_∞ is the free-stream velocity, a is the radius of the impact tube, ρ is the fluid density, and ν is the kinematic viscosity of the fluid. Above Reynolds numbers of 1000, there is no effect of viscosity, and C_p is equal to unity. Between Rey $\cong$ 50 and Rey $\cong$ 1000, C_p is slightly less than unity, but has a minimum value of 0.99. For values of Rey less than 50, C_p is always greater than unity. When the Reynolds number is below unity, the pressure rise is independent of the fluid density, and the data may be represented approximately by the formula $C_p \cong 5.6/\text{Rey}$.

The results are compared with the experimental investigations of Barker and of Homann, and with the theoretical studies of Stokes and of Homann.

Dynamic Load Characteristics in Plastic Bending of Beams, by P. S. Symonds, Mem. ASME, Brown University, Providence, R. I. 1953 ASME Applied Mechanics Division Conference paper No. **53—APM-26** (in type; to be published in the *Journal of Applied Mechanics*).

THIS paper continues work previously reported on the analysis of large plastic deformations of beams subjected to transverse dynamic loads. The paper discusses the numerical analysis for central concentrated force pulses of arbitrary shape, using a somewhat different formulation of the equations than in the previous paper.

Results are collected for three types of force pulse: A rectangular pulse, a half-sine wave, and a triangular pulse. These show that the central angle of permanent deformation for all three cases can be computed from the empirical formula $\theta_0 = CI^2 P_m^{2/3}$, where I is the impulse, P_m is the maximum load value, and C depends on the dimensions and properties of the beam, with a numerical factor that varies by about ± 15 per cent from the value for the half-sine wave pulse to those for the other two pulse types.

Transverse Impact on Beams and Plates, by A. C. Eringen, Illinois Institute of Technology, Chicago, Ill. 1953 ASME Applied Mechanics Division Conference paper No. **53—APM-27** (in type; to be published in the *Journal of Applied Mechanics*).

FLEXURAL deflections of several plates and beams under an unknown transverse, concentrated, time-dependent force are solved for various edge conditions.

The consideration of displacements and the use of Hertz's law of impact at the point of contact lead to a nonlinear integral equation for the contact force in all cases of transverse impact. Two methods are introduced to treat this equation: (*a*) Generalized Galerkin; (*b*) collocation. Method (*a*) is the generalization of the well-known Galerkin method which is suitable for the problems in which part of the boundary is unknown in advance, while certain conditions are given there. The method is applicable to a very large class of differential and integral equations. The collocation method leads to a quick, reasonable, approximate solution.

Various auxiliary curves in both cases reduce the solution to a routine. Examples are worked out and plotted for various beams and plates. Deflections are plotted.

Analysis of Viscous Laminar Incompressible Flow Through Axial-Flow Turbomachines With Infinitesimal Blade Spacing, by T. P. Torda, H. H. Hilton, Jun. ASME, and F. C. Hall, University of Illinois, Urbana, Ill. 1953 ASME Applied Mechanics Division Conference paper No. **53—APM-28** (in type; to be published in the *Journal of Applied Mechanics*).

THE Lorenz theory has been extended to the viscous, laminar, incompressible flow through axial-flow turbomachines with infinitesimal blade spacing. Expressions are derived for the velocity components, pressure, power input, and output for arbitrary blade surfaces.

A numerical example is presented and the flow variables and blade surfaces are plotted.

Buckling of Multiple-Bay Ring-Reinforced Cylindrical Shells Subject to Hydrostatic Pressure, by W. A. Nash, Mem. ASME, David Taylor Model Basin, Navy Department, Washington, D. C. 1953 ASME Applied Mechanics Division Conference paper No. **53—APM-29** (in type; to be published in the *Journal of Applied Mechanics*).

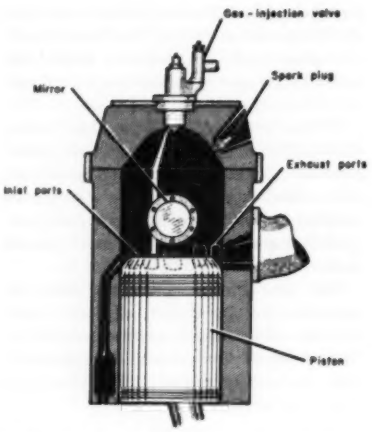
AN analytical solution is presented in this paper for the problem of the elastic instability of a multiple-bay ring-reinforced cylindrical shell subject to hydrostatic pressure applied in both the radial and axial directions. The method used is that of minimization of the total potential.

Expressions for the elastic strain energy in the shell and also in the rings are written in terms of displacement components of a point in the middle surface of the shell. Expressions for the work done by the external forces acting on the cylinder likewise are written in terms of these displacement components.

A displacement configuration for the buckled shell is introduced which is in agreement with experimental evidence, in contrast to the arbitrary patterns assumed by previous investigators. The total potential is expressed in terms of these displacement components and is then minimized. As a result of this minimization a set of linear homogeneous equations is obtained. In order that a nontrivial solution to this system of equations exists, it is necessary that the determinant of the coefficients vanish. This condition determines the critical pressure at which elastic buckling of the cylindrical shell will occur.

Correction

A Photographic Study of Events in a 14-In. Two-Cycle Gas-Engine Cylinder, by R. L. Boyer, Mem. ASME, and D. R. Craig, The Cooper-Bessemer Corp., Mount Vernon, Ohio, and C. D. Miller, Battelle Memorial Institute, Columbus, Ohio. 1953 ASME Spring Meeting paper No. **53—S-45** (mimeographed; to be published in Trans. ASME).



SECTION OF TEST CYLINDER SHOWING ORIENTATION OF FIELD OF VIEW FOR PHOTOGRAPHY THROUGH CYLINDER WALL

Because of an error in page makeup, the wrong diagram was used to illustrate the digest of the foregoing paper published on page 585 of the July, 1953, issue of MECHANICAL ENGINEERING. The accompanying illustration is the one which should have appeared with the article.

ASME Transactions for July, 1953

THE July, 1953, issue of the Transactions of the ASME (available at $1 per copy to ASME members; $1.50 to nonmembers) contains:

Air-Preheater Design as Affected by Fuel Characteristics, by Hilmer Karlsson and W. E. Hammond. (52—A-125)

Tubular Air-Heater Problems, by E. F. Rothemich and G. Parmakian. (52—A-124)

Contamination of Condensate by Heat-Exchanger-Tube Alloys, by J. D. Ristroph and E. B. Powell. (52—A-63)

The Motion of a Link Chain Over a Roller, by A. E. R. de Jonge. (52—A-55)

Effect of Rotary Regenerator Performance on Gas-Turbine-Plant Performance, by D. B. Harper and W. M. Rohsenow. (52—A-149)

The Rotary Regenerative Air Preheater for Gas Turbine, by A. T. Bowden and W. Hryniszak. (52—A-74)

The Periodic-Flow Regenerator—A Summary of Design Theory, by J. E. Coppage and A. L. London. (52—A-93)

A Practical Solution of a Three-Dimensional Flow Problem of Axial-Flow Turbomachinery, by L. H. Smith, Jr., S. C. Traugott, and G. F. Wislicenus. (52—A-168)

Some NACA Research on Centrifugal Compressors, by I. A. Johnsen and Ambrose Ginsburg. (52—A-131)

Complete Characteristic Circle Diagrams for Turbomachinery, by W. M. Swanson.

Theoretical Consideration of Retarded Control, by G. H. Cohen and G. A. Coon.

A Fast-Response True-Mass-Rate Flowmeter, by Yao Tzu Li and Shih-Ying Lee. (52—A-170)

Optimum Three-Mode Controller Settings for Automatic Start-Up, by D. W. Pessen. (52—A-58)

Analogies for Hydraulic and Electric Drives in Servomechanisms, by Yaohan Chu and L. A. Gould. (52—A-101)

Laminar-Flow Forced Convection in Rectangular Tubes, by S. H. Clark and W. M. Kays.

Effect of Stress Amplitude on Statistical Variability in Fatigue Life of 75S-T6 Aluminum Alloy, by G. M. Sinclair and T. J. Dolan. (52—A-82)

Grinding and Lapping Stresses in Manganese Oil-Hardening Tool Steel, by H. R. Letner and H. J. Snyder. (52—A-38)

Workpiece and Surface Temperatures in Milling, by A. O. Schmidt. (52—A-86)

Creep of Neoprene in Shear Under Static Conditions; Ten Years, by W. N. Keen.

Stress-Crazing of Plastics, by J. A. Sauer and C. C. Hsiao. (52—A-100)

Some Design Considerations for Injection-Molding Heating Chambers, by G. D. Gilmore and G. B. Thayer. (52—A-105)

Furnace Heat Absorption in a Spreader-Stoker-Fired Steam Generator, Part 1, by J. W. Myers and R. C. Corey. (52—A-143)

Furnace Heat Absorption in a Spreader-Stoker-Fired Steam Generator, Part 2, by F. G. Feeley, Jr., and E. C. Miller. (52—A-142)

The Venturi as a Meter for Gas-Solids Mixtures, by Leonard Farbar. (52—A-31)

Experimental Evaluation of Expansion Factors for Steam, by J. W. Murdock and C. J. Foltz. (52—A-52)

Measurement of Pulsating Flow With Propeller and Turbine-Type Meters, by R. B. Dowdell and A. H. Liddle, Jr. (52—A-32)

The Pitot-Venturi Flow Element Water-Service Report, by H. W. Stoll.

REVIEWS OF BOOKS

And Notes on Books Received in the Engineering Societies Library

Teamwork in Research

TEAMWORK IN RESEARCH. Edited by George P. Bush and Lowell H. Hattery with a foreword by Howard A. Meyerhoff. The American University Press, Washington, D. C., 1953. Cloth, $5^3/_4 \times 9$ in., figs., tables, bibliographies, indexes, xii and 191 pp., $4.

REVIEWED BY F. S. MALLETTE[1]

ANY activity involving the expenditure of over two billion dollars in this country alone is certain to arouse considerable discussion on its nature, function, value, and administration. Inevitably, informal talks of its problems lead to numerous meetings and to ultimate development and organization of a specialized type of personnel to direct its programs. Such a pattern has been followed by research management which today has its own association and technical literature.

This book is adapted from the proceedings of the Third Institute on Administration of Scientific Research and Development presented at Washington, D. C., by The American University with the co-operation of the National Research Council and the American Association for the Advancement of Science. Almost a score of authors from the academic, governmental, industrial, and consulting fields discuss the phenomenon of team research.

Research has always involved co-operation even when undertaken by the Edisonian type of investigator, who relied largelyu pon "inspiration." The achievement of such a genius is facilitated by the experiences of previous workers as well as by his own helpers and assistants. However, today research has become so complex that many highly specialized talents are required. As a result, teamwork in research is a necessity.

How best to organize and channel the efforts of such teamwork is discussed in this volume from varied points of view. The organizationl patterns range from the conservative industrial type to the extreme wartime "Section T" system which, among other things, developed the proximity fuse. In the former, the use of corporation funds demands that a strenuous effort be made to produce the most for the money; in the latter, time meant lives and, aptly, one of the slogans of this group was: "*I don't want any man in this outfit to save money. I only want him to save time.*"

Tangible evidence of the existence of teamwork in research is provided by the startling increase in joint authorship of publications during the past thirty years. However, despite this increase there has been no corresponding decrease in the number of single authors even though they have declined percentage-wise. Too the book intimates that, judging from problems arising from personalities, scientists are still individualists but, through team spirit, they can be induced to piece together the jigsaw puzzle resulting from the specializations into new technological combinations.

The book is divided into four principal parts: (1) Organization, (2) personnel factors, (3) aids to teamwork, and (4) case examples. Each author was assigned a topic, but there is, of necessity, some duplication, not all of which is without value because of each writer's different point of view.

Anyone who is responsible for organizing or directing research programs should find this volume helpful. There is a name and a subject index.

[1] Research Manager, The American Society of Mechanical Engineers, New York, N. Y. Mem. ASME.

Books Received in Library

ASTM STANDARDS ON LIGHT METALS AND ALLOYS. Sponsored by ASTM Committee B-7 on Light Metals, Alloys, Cast and Wrought. American Society for Testing Materials, Philadelphia, Pa., 1953. 205 p., 9×6 in., paper. $3. This special compilation brings together some 50 specifications and tests covering the following subjects: aluminum and aluminum-base ingots, castings, bars, rods, wire and shapes, forgings, pipe and tubes, sheet and plate; wrought products for electrical purposes including various types of electrical conductors, and a test for resistivity; magnesium and magnesium-base ingots, castings, forgings, and shapes; general test methods for dielectric strength and tension testing; two specifications for filler metal-electrodes and brazing material; and a recommended practice for electroplating.

ADVENTURES—IN THE NAVY, IN EDUCATION, SCIENCE, ENGINEERING AND IN WAR. By W. F. Durand. The American Society of Mechanical Engineers and McGraw-Hill Publishing Company, Inc., New York, N. Y., 1953. 212 p., $8^3/_4 \times 5^3/_4$ in., bound. $4. In this unpretentious but lively account of his long and varied engineering career, Dr. Durand has recorded what he considers the most memorable events of his life. Material included ranges from childhood memories of a New England boyhood to his invention of a radial planimeter, his work in hydro- and aerodynamics, his part in the design and construction of the Hoover Dam, and his many other important contributions. A bibliography of the author's published works is included.

AIRCRAFT PROPULSION—THEORY AND PERFORMANCE. By A. W. Morley. Longmans, Green and Company, New York, N. Y., 1953. 221 p., $10 \times 6^1/_2$ in., bound. $5.50. All the important systems of aircraft propulsion are surveyed in this introductory textbook for engineering and science students. The outlook is specifically theory and performance rather than design. It presents the basic principles governing the output and efficiency of the turbojet, propeller turbine, piston engine, ramjet, and rocket motor as applied to modern aircraft. Such subjects as the thrust required for flight, compressor, and turbine characteristics, axial-flow theory, supercharger matching, and ramjet intake performance are considered.

ANALYSIS OF ALUMINUM ALLOYS. Edited by G. H. Osborn and W. Stross. Chemical Publishing Company, Inc., New York, N. Y., 1953. 144 p., $8^3/_4 \times 5^3/_4$ in., bound. $3.50. This book is a listing of methods of analysis, comprising part of the material gathered by a group of British firms in a survey of practices in member laboratories. It covers, for the common elements, gravimetric, volumetric, photometric, electrolytic, and polarographic methods; and also describes methods for the less common elements such as beryllium, bismuth, and sodium. Two composite schemes are given for the photometric determination of several elements from one weighing. Detailed procedures are given in line with the emphasis on practical application.

APPLIED KINEMATICS FOR STUDENTS AND MECHANICAL DESIGNERS. By J. Harland Billings. D. Van Nostrand Company, Inc., New York, N. Y., third edition, 1953. 352 p., $9^1/_4 \times 6^1/_4$ in., bound. $4.50. The principles governing motion and the design of machine elements are presented; as far as possible, simple graphical methods are used. The illustrative material and problems are closely related to engineering practice. The chief elements in the revision are the addition of a new chapter on automatic control and its mechanisms and an appendix containing a group of "problems for the drafting room."

BASIC MECHANICS OF FLUIDS. By Hunter Rouse and J. W. Howe. John Wiley and Sons, Inc., New York, N. Y., 1953. 245 p., 9¼ × 6¼ in., bound. $4.50. This is a textbook for junior students, similar in theme to Professor Rouse's "Elementary Mechanics of Fluids" (1946), but completely rewritten, with minor rearrangements of material. Major subjects covered are the principles of fluid statics; kinematics of fluids; the effects of weight, viscosity, and compressibility; resistance to flow under various conditions; and a brief chapter on lift and propulsion. General methods of analysis are stressed rather than isolated procedures, and the emphasis on useful application is shown in the problems as well as in the text.

CAST BRONZE. By Harold J. Roast. American Society for Metals, Cleveland, Ohio, 1953. 458 p., 9¼ × 6¼ in., bound. $4. Beginning with a chapter on the layout and equipment of a theoretical bronze foundry, the author continues with the purchase and handling of metal; with fuels, furnaces, and foundry sand; and with the making of castings, cores, and dry-sand molds. He discusses the general metallurgy and testing of metals, and then takes up the commercial and special types of bronzes in separate chapters. The engineer's viewpoint is considered particularly with respect to specifications and properties, and there is a long historical summary of bronze casting.

ÉTAT ACTUEL ET VALEUR DE LA THÉORIE HYDRO-THERMODYNAMIQUE DES EXPLOSIONS ET DES CHOCS. By Serge Travers. Eyrolles Éditeur, Paris, France. Two volumes. Vol. 1, 1950, 9¾ × 6½ in., paper. 900 fr. Vol. 2, 1951, 9¾ × 6½ in., paper. 1900 fr. An exposition of the current status of the hydrothermodynamic theory of explosions and shocks. Part 1 deals with pure shock waves and compressibility by shock without combustion, covering the general formulas, the phenomena of shock waves in gases, liquids, and solids, and the general thermodynamics of shock waves. Part 2 deals with the thickness of the shock wave and the mechanism of ignition in combustion waves and covers the following: diffusion, thermal conductivity, and viscosity in shock and combustion waves; detonation waves and the critical-wave theory; comparison of deflagration with detonation. The pagination of the original publications of which these sections formed a part has been retained.

EXPERIMENTAL NUCLEAR PHYSICS. Volume 1. Edited by E. Segré. John Wiley and Sons, Inc., New York, N. Y., 1953. 789 p., 9⅜ × 6⅛ in., bound. $14. This is the first volume of a three-volume summary of the main results of nuclear-physics research, to cover experimental techniques, significant facts and data, and the broad lines of theoretical interpretation. The five parts of the present volume, each a reasonably complete treatise on a restricted subject, deal respectively with the following topics: detection methods; passage of radiations through matter; nuclear moments and statistics; nuclear two-body problems and elements of nuclear structure; charged-particle dynamics and optics, relative isotopic abundances of the elements, and atomic masses. Extensive references to the original literature are given.

GANTT CHART. A Working Tool of Management. By Wallace Clark. Sir Isaac Pitman and Sons, Ltd., London, England (distributed in U. S. by Pitman Publishing Corporation, New York, N. Y., third edition, 1952. 168 p., 8¾ × 5¾ in., bound. $3.50. A comprehensive explanation of the principle of the Gantt Chart and the form and operation of the major varieties of charts: machine record, man record, layout, project planning, load, progress, and executive direction. Practical applications are extensively used throughout and there is a special chapter on applications in various industrial fields from a machine shop to merchant-marine operations. The whole treatment is thoroughly practical.

GENERAL DISCUSSION ON HEAT TRANSFER, PROCEEDINGS. (September 11–13, 1951). The Institution of Mechanical Engineers. (Available in U. S. from The American Society of Mechanical Engineers, New York 18, N. Y.) 496 p., 11¼ × 9 in., bound. $10. The object of this symposium is to review developments in the knowledge of the principles of the transference of heat and in the design of apparatus making use of such knowledge, within the period 1940–1950. Ninety-three papers are presented divided under five main headings: heat transfer with change of state; heat transfer between fluids and surfaces; conduction in solids and fluids; radiation, instrumentation, measurement techniques, and analogies; special problems such as heat transfer in turbine-blade cooling in liquid metals, in gas turbines, etc. A special lecture on "problems in design and research on condensers of vapors and vapor mixtures" is included. Papers were contributed by specialists from several other countries as well as from the United States and Great Britain.

HANDBOOK OF GLASS MANUFACTURE. Compiled and edited by Fay V. Tooley. Ogden Publishing Company, New York, N. Y., 1953. 506 p., 9¼ × 6¼ in., bound. $11.50. Designed as a reference book for the production executive, engineer, and technologist, this book covers glass-manufacturing principles, materials, and equipment. Following discussion of compositions, properties, and raw materials, the book deals with instruments, furnaces and fuels, refractories, and the procurement, preparation, and handling of materials. The process of glass preparation is then treated as a whole, and separate sections are devoted to feeding and forming, annealing and tempering, and glass decoration. References are listed after each topic, and a section of auxiliary information includes pertinent tables, ASTM standards, a glass glossary, and other data.

HEATING, VENTILATING, AIR CONDITIONING GUIDE. 1953. American Society of Heating and Ventilating Engineers, New York, N. Y., vol. 31, 1953. 1560 p., 9¼ × 6¼ in., bound. $7.50. The fifty-one chapters of this standard reference work cover a wide range of topics: fundamentals of thermodynamics; the physiological bases of heating and air conditioning; calculation of heating and cooling loads of enclosed spaces; descriptions of systems and apparatus such as steam heating, panel heating, electric heating, refrigeration, and drying systems. It also includes instrumentation, pertinent codes and standards, a glossary of terms, and lists of abbreviations and symbols. There are detailed indexes, and the usual condensed manufacturers' catalog section is appended.

INGRANAGGI CILINDRICI. By Francesco Modugno. Ulrico Hoepli, Milan, Italy, 1951. 487 p., 9¾ × 7 in., paper. 3800 Lire. The design, mathematical analysis, and construction of spur gears are fully described. Some of the chapter topics included are the kinematic principles of spur gears, the measurement, cutting, and grinding of gear teeth, lateral-pressure specifications, gear efficiency, driving mechanisms, and the important problem of gear-teeth failures. The book is a complete revision of the 1940 edition, "Theory and Construction of Spur Gears," and covers the progress made in the field, with some attention to the specific application of gears to marine propulsion.

MANUAL OF ENGINEERNG DRAWING FOR STUDENTS AND DRAFTSMEN. By Thomas E. French and Charles J. Vierck. McGraw-Hill Book Company, Inc., New York, N. Y., eighth edition, 1953. 715 p., 9½ × 6½ in., bound. $8. This new edition has been rearranged into four basic divisions: fundamentals of shape description, including pictorial sketching, perspective, and intersections; size descriptions, covering dimensioning and the relationship between the drawings and the shop; discussion of basic machine elements; and the section on working drawings, including related specialties—architectural, structural, map, and topographic drawing. The usual information on lettering, the selection and use of instruments, and the making of charts and graphs is included, as are brief glossaries of pertinent terms.

MATERIALS HANDLING. By John R. Immer. McGraw-Hill Book Company, Inc., New York, N. Y., 1953. 591 p., 9¼ × 6¼ in., bound. $8. This book is designed both as a college text and as a guide for the experienced handling engineer. Particular attention is paid to the organizational, cost, and managerial aspects of handling methods and equipment. Separate sections are devoted to packaging, the analysis of handling problems, the organization of handling within the company, and such special problems as machine operations, air-cargo handling, and the handling of bulk materials, in addition to a list of selected sources of information. The appendix includes references classified by industries, a list of visual aids, and a detailed decimal classification scheme for materials-handling information.

MECHANICAL ENGINEERING THERMODYNAMICS. By David A. Mooney. Prentice-Hall, Inc., New York, N. Y., 1953. 540 p., 9¾ × 6 in., bound. $9.35. An introductory textbook for students with college physics and mathematics, including elementary calculus. The usual topics are discussed in the general order of basic concepts, principles, data on substances, and engineering applications, with detailed examples and explanations employed to clarify points of procedure. Considerable emphasis is placed on the background and significance of laws and definitions. References are listed at the end of some chapters and pertinent tables and charts are included.

NICHTMETALLISCHE ANORGANISCHE ÜBERZÜGE. By Willi Machu. Springer-Verlag, Vienna, Austria, 1952. 404 p., 9¾ × 7 in., bound. $13.50. A comprehensive review of the practical and industrially important nonmetallic coatings for commercially produced metals

and alloys. The following groups of processes are dealt with in detail: electrolytic and chemical oxidation processes for the light metals; metallic coloring of metals; phosphating and enameling; coatings from silicates, graphite, nitrides, sulphur, and selenium; and rarely used surface-improvement processes for zinc, tin, copper, silver, and gold. There are author and subject indexes, and 1800 references to the technical literature and patents.

POLICY FOR SCIENTIFIC AND PROFESSIONAL MANPOWER. By the Research Staff of the National Research Council. Columbia University Press, New York, N. Y., 1953. 263 p., 9¼ × 6¼ in., bound. $4.50. This report consists of two parts: a statement of policy for scientific and professional manpower, and a study of the facts upon which the policy recommendations are based. The first part gives the Council's recommendations to government, industry, and educational institutions, designed to provide the nation with adequately trained scientific and professional workers. The second part depicts and analyzes existing shortages, discusses the actual and potential educational attainments of the population, and considers factors impeding the training of capable persons. Separate chapters give detailed appraisals of shortages of engineers, physicists, teachers, and medical personnel. The concluding chapter deals with present public policies and attitudes toward scientists and professional men.

ASME BOILER CODE

Interpretations

THE Boiler Code Committee meets monthly to consider "Cases" where users have found difficulty in interpreting the Code. These pass through the following procedure: (1) Inquiries are submitted by letter to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N. Y.; (2) Copies are distributed to Committee members for study; (3) At the next Committee meeting interpretations are formulated to be submitted to the ASME Board on Codes and Standards, authorized by the Council of the Society to pass upon them; (4) They are submitted to the Board for action; (5) Those which are approved are sent to the inquirers and are published in MECHANICAL ENGINEERING.

(The following Case Interpretations were formulated at the Committee meeting April 30, 1953, and approved by the Board on July 3, 1953.)

CASE NO. 1114–1 (REOPENED)

(Special Ruling)

Inquiry: Will unfired pressure vessels fabricated by fusion welding under the general requirements of Pars. U-68, U-69, and U-70 meet the intent of the Code if the base material is aluminum-manganese-magnesium alloy MG11A of Specification SB-178 and/or SB-274?

Reply: It is the opinion of the Committee that the aluminum-manganese-magnesium alloy MG11A described in Specification SB-178 may be used for the construction of unfired pressure vessels under the conditions that:

(1) Sheet and plate meet the applicable requirements of Spec. SB-178.

(2) Tubing meets the applicable requirements of Specification SB-274.

(3) Fabrication is by fusion welding using electrodes complying in composition with (1) SB-184 electrode classification Al-43, (2) composition of the parent material, or (3) the following:

Magnesium, per cent	3.1–3.9
Chromium, per cent	0.15–0.35
Copper (max), per cent	0.10
Manganese (max), per cent	0.10
Zinc (max), per cent	0.20
Iron plus silicon (max), per cent	0.45
Other (each), per cent	0.05
Other (total), per cent	0.15
Aluminum	remainder

The stresses allowed for the parent plate shall be modified by the welding efficiency factor. When welding rod Al-43 is used for main seams, it is not permissible to have openings or welded connections in or adjacent to those seams within a distance of three plate thicknesses. Welding rod Al-43 shall not be used for welding connections into the vessel wall. The general rules of Pars. U-68, U-69, or U-70 shall be followed. In addition to the general rules of Par. U-69, portions of the completed welded joints shall be examined either by spot radiographing, by sectioning, or by a combination of both methods. The welds shall meet the standards outlined in Par. U-208, until such time as acceptable standards are developed and approved for aluminum-alloy welds. The requirements of Par. Q-109, Note C, and the Note in Par. Q-209, 1949 Edition, shall apply to vessels constructed under the rules of Par. U-68.

(4) The welding requirements of Section IX, 1949 Edition and the applicable paragraph apply except that:

(a) The tensile strength of the reduced section tension specimens shall be not less than 23,000 psi.

(b) The elongation as determined by the free-bend test shall be not less than 8 per cent for welds made with SB-184-Al-43 rods, and not less than 15 per cent for welds made with rods of the other compositions allowed.

(c) Qualification tests made on a given thickness of material shall apply to thicknesses varying as much as ±50 per cent from that thickness. Not more than two thicknesses need be qualified. They shall include the minimum and maximum thicknesses under consideration.

(5) The following maximum allowable working stresses are to be used in applying the design rules where reference is made to Table U-3 or Table U-2:

		Metal temperature not exceeding deg F			
Temper		100	150	200	
O		5650	5650	5650	
H32		7000	7000	6700	
H34		8000	8000	7600	
H112		5750	5750	5750	
Temper	250	300	350	400	
O	5500	4650	3850	3150	
H32	6050	5300	4500	3750	
H34	6900	6100	5200	4350	
H112	5500	4650	3850	3150	

(6) For welded joints, the allowable working stresses for annealed material are used.

(7) For U-70 construction, the joint efficiency to be used in applying the design rules is taken as the ratio of the *SE* values given in Par. U-70(a) and U-70(b) divided by 13,750.

(8) Thermal stress relieving is not required.

(9) In view of the fact that this alloy is not one of those which suffer loss of impact resistance at low temperatures, the requirements of Pars. U-140 to U-142 inclusive shall not apply for service above —325 F.

(10) In the hydrostatic test, the test pressure is not less than 1.15 times the maximum working pressure.

(11) Bolting materials conform to alloy and temper of GS11A-T6 or CG42A-T4 of Specification SB-273 or to one of the grades of alloy steel of Specification SA-193. The allowable working stresses for GS11A-T6 and CG42A-T4 are as follows:

Material		100	150	200
GS11A-T6		7000	6700	6450
CG42A-T4		8000	7750	7500
Material	250	300	350	400
GS11A-T6	5900	5000	4000	2900
CG42A-T4	7200	6200	4900	3650

CASE NO. 1166

Inquiry: May the special seamless vessels described in Par. UG-67(f), 1950 edition of Section VIII, have openings exceeding ¾ inch pipe size? Are

impact tests necessary when the designed temperature is above −20 F?

Reply: It is the opinion of the Committee that special seamless vessels constructed under Par. UG-67(f), 1950 edition of Section VIII, and Par. UCS-67(e), 1952 edition, may have the general design as outlined in Figs. UG-67 and UCS-67, respectively. In the forming operation, the heads shall be shaped and thickened to provide details of design and construction of the center opening, (A) (which need not be limited to $^3/_4$ inch pipe size), which will be as safe as those provided by the rules of the Code. Any additional openings in the vessel shall not exceed $^3/_4$ inch pipe size and shall be placed in the thickened part at or near the head at a point where the calculated stress, without holes, is not more than one-half of the maximum allowable stress value. The impact test is not required when these vessels are constructed for operation in the temperature range of −20 F to 450 F.

Proposed Revisions and Addenda to Boiler and Pressure Vessel Code

AS need arises, the Boiler Code Committee entertains suggestions for revising its Codes. Revisions approved by the Committee are published here as proposed addenda to the Code to invite criticism. If and as finally approved by the ASME Board on Codes and Standards, and formally adopted by the Council, they are printed in the annual addenda supplements to the Code. Triennially the addenda are incorporated into a new edition of the Code.

In the following the paragraph numbers indicate where the proposed revisions would apply in the various sections of the Code.

Comments should be addressed to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N. Y.

Power Boilers, 1952

PAR. P-105(a) Delete the sentence: "The reinforcement may be machined off if so desired."

PAR. P-112(c) Add as the next to the last sentence in the second paragraph: "The reinforcement may be removed if so desired."

PAR. P-317(a) Add as a last sentence: "On single boiler-turbine unit installations the boiler feed shut-off valve may be located upstream from the boiler feed check valve."

TABLE P-7 Under CASTINGS add the following stress value for SA-217 Grade WC-6:

1050 F	5500		

Material Specifications, 1949

EDITORIAL NOTE

The Boiler Code Committee has approved adding to Section II the following new specifications:

Castings
SA-47 (A-47-52)

Plates
SA-7 (A-7-52T)
SA-30 (A-30-52T)
SA-113 (A-113-52T)
SA-129 (A-129-52T)
SA-201 (A-201-52aT)
SA-202 (A-202-52aT)
SA-203 (A-203-52T)
SA-204 (A-204-52T)
SA-212 (A-212-52T)
SA-225 (A-225-52aT)
SA-283 (A-283-52T)
SA-299 (A-299-52T)
SA-300 (A-300-52T)
SA-301 (A-301-52T)
SA-302 (A-302-52T)
A-357-52T

Tubular Products
SA-53 (A-53-52T)
SA-83 (A-83-52T)
SA-106 (A-106-52T)
SA-135 (A-135-51T)
SA-178 (A-178-51)
SA-192 (A-192-51T)
SA-209 (A-209-51T)
SA-210 (A-210-52T)
SA-213 (A-213-52T)
SA-226 (A-226-51T)
SA-250 (A-250-51T)
SA-335 (A-335-52aT)
SA-72 (A-72-52T)

Forgings & Misc. Materials
SA-31 (A-31-52T)
SA-84 (A-84-52T)
SA-182 (A-182-52aT)
SA-193 (A-193-52T)
SA-306 (A-306-52aT)
SA-307 (A-307-52T)
SA-320 (A-320-52T)
SA-325 (A-325-52T)
A-354-52T

Stainless Steel
SA-213 (A-213-52T)
SA-249 (A-249-52T)
SA-271 (A-271-52)

Non-ferrous Materials
SB-12 (B-12-52)
SB-26 (B-26-52T)
SB-42 (B-42-52)
SB-43 (B-43-52)
SB-61 (B-61-52)
SB-98 (B-98-52)
SB-108 (B-108-52T)
SB-111 (B-111-52)
SB-169 (B-169-52)
SB-171 (B-171-52)
B-259-52T
B-260-52T

The stress values for Specification SA-352-52T as they will appear in Table UCS-23 are as follows:

Mat'l & Spec. No.	Grade	Nom. Comp'n	Spec. Min. Tens. Str.
CASTINGS			
Carbon Steel			
SA-352	LCB	...	65000
Low-Alloy Steels			
SA-352	(3 grades)	...	65000
	Notes	−20 to 650 F	700 F
CASTINGS			
Carbon Steel			
SA-352	(7)(16)	16250	...
Low-Alloy Steels			
SA-352	(7)(8)(16)	16250	...

Unfired Pressure Vessels, 1952

PAR. UCS-57 Revise to read:

UCS-57 Radiographic Examination In addition to the requirements in Par. UW-11, complete radiographic examination is required for each butt welded joint in vessels built of steel complying with Specifications SA-202, SA-203, SA-204, SA-212, SA-225, SA-299, SA-301, and SA-302, at which the plate thickness exceeds 1 in. (See Par. UW-11.)

PAR. UCS-67(e) Add as a new paragraph (4):

(4) The heads are shaped and thickened in the forming operation to provide details of design and construction of the center opening (A) which will be as safe as those provided by the rules of this Code.

Renumber succeeding paragraphs, changing present (4) to (5), (5) to (6), (6) to (7), and (7) to (8), and change the first word of present (4), new (5), from "outlet" to "other."

PAR. UA-52 Add as a new paragraph:

UA-52 Split Loose Flanges[1] Loose flange split across a diameter and designed under the rules given in Part A of this Appendix may be used under the following provisions:

(a) When the flange consists of a single split flange or flange ring, it shall be designed as if it were a solid flange (without splits), using 200 per cent of the total moment M_o as defined in Par. UA-49(b).

(b) When the flange consists of two split rings, each ring shall be designed as if it were a solid flange (without splits), using 75 per cent of the total moment M_o as defined in Par. UA-49(b). The pair of rings shall be assembled so that the splits in one ring shall be 90 deg from the splits in the other ring.

(c) The splits should preferably be midway between bolt holes.

[1] Loose flanges of the type shown in sketch (1) of Fig. UA-48 are of the split design when it is necessary to install them after heat-treatment of a stainless steel vessel, or when for any reason it is desired to have them completely removable from the nozzle neck or vessel.

PAR. UW-37(f) Revise to read:

(f) Each welder and welding operator shall stamp the identifying number, letter, or symbol, assigned by the manufacturer, adjacent to and at intervals of not more than 3 ft along the welds which he makes in steel plates $^1/_4$ in. and over in thickness; or a record shall be kept by the manufacturer of welders and welding operators employed on each joint which shall be available to the inspector. For identifying welds on vessels in which the wall thickness is less than $^1/_4$ in. for steel material and less than $^1/_2$ in. for non-ferrous material, suitable stencil or other surface markings shall be used; or a record shall be kept by the manufacturer of welders and welding operators employed on each joint which shall be available to the inspector.

PAR. UG-35 Add the following note:

NOTE: Removable closures for ends of pressure vessels, manways, and similar openings which are not of the multi-bolted type shall be so arranged that the failure of one holding element will not release all the others. Such devices shall be arranged to permit visual examination to assure proper and positive engagements of the holding devices.

Announcement

A list of the changes made in the first printing of the 1952 Unfired Pressure Vessel Code that were incorporated in the Revised (second) Printing is available from Society headquarters.

ASME NEWS

With Notes on the Engineering Profession

1953 ASME Fall Meeting Technical Program Offers Important Current Information in Many Avenues of Engineering

Sheraton Hotel, Rochester, N. Y., October 5–7, Meeting Headquarters

AVAILABLE preprints of numbered papers may be purchased from ASME Order Department, 29 West 39th Street, New York 18, N. Y. Please order by number as listed in program. The tentative program follows:

Tentative Program

MONDAY, OCTOBER 5

8:00 a.m.

Registration

9:30 a.m.

Machine Design (I)

Analytical Approach to the Design of Quadric Chain Mechanisms, by *Ferdinand Freudenstein*, Columbia University (Paper No. 53—F-10)

Minimization of Gear-Train Inertia, by *Edward G. Burgess, Jr.*, Ford Instrument Co. (Paper No. 53—F-13)

9:30 a.m.

Production Engineering (I)

Cost Reduction in a Large Shop, by *F. Gehret*, E. I. du Pont de Nemours Co.

Profits Through Effective Machine-Replacement Programs, by *Carl M. Beach*, Cincinnati Milling Machine Co.

9:30 a.m.

Process Industries

Design Considerations of Vacuum Systems Based on the Oil-Vapor Ejector-Type Vacuum Pump, by *Gordon P. Gerow*, Consolidated Vacuum Corp.

A Survey of Columns, by *Ernest W. Neben*, The Pfaudler Co.

12:15 p.m.

President's Luncheon

Presiding: *C. W. de Kiewiet*, president of the University of Rochester

Speaker: The President, *Frederick S. Blackall, jr.*, Fellow ASME

Subject: **ASME Standards Save Lives and Dollars**

2:30 p.m.

Machine Design (II)

Some Problems in the Design of a Differential-Pressure Transmitter, by *James R. Davidson*, Taylor Instrument Cos.

An Illustration of Automatic Assembly, by *Charles Kraus*, Kraus Design Inc. (Paper No. 53—F-11)

2:30 p.m.

Production Engineering (II)

Product Design For Lower Manufacturing Costs, by *M. E. Brown*, Eastman Kodak Co.

Tumbling Costs and Performance on Small Machine-Tool Parts, by *J. G. Reed*, Brown and Sharpe Manufacturing Co.

2:30 p.m.

Rochester Section

Mechanical Analysis by Means of High-Speed Photography, by *John H. Waddell*, Wollensak Optical Co.

Diversification of Photography in the Aircraft Field, by *Earl G. Stanton*, Bell Aircraft Co.

The Use of Optical Measurements in Engineering, by *Nisson A. Finkelstein*, Bausch & Lomb Optical Co.

Some Startling Revelations in Industrial Photomicrography, by *C. S. Foster*, Eastman Kodak Co.

5:00 p.m.

Calvin W. Rice Lecture

Presiding: (To be announced)

Speaker: *J. Foster Petree*, Editor *Engineering*, London, England

Subject: **The Position of the Technical Press in Relation to Industry**

8:00 p.m.

Junior

Speakers: *Alexander M. Beebee*, president, Rochester Gas & Electric Corp., Rochester, N. Y., and *Charles J. Hudson*, quality control consultant, Norton Co., Worcester, Mass.

Subject: **Engineering—Opportunity Unlimited**

Guests of the Old Guard—Representing Sections in Region III

KODAK PARK WORKS TO BE VISITED

(Eastman Kodak Company manufactures photographic papers, photographic films, photographic chemicals and synthetic organic chemicals, and processes colored films in its processing laboratories. Highly integrated, it builds its own buildings and machines, makes its own boxes, does its own printing, and supplies its own power and water. Also located in the Park are the company's research laboratories and its mammoth distribution center for shipping all the products manufactured in the four Rochester plants.)

Anthracite Lehigh Valley
John H. Fernandes

Baltimore
Ralph W. Miller

Buffalo
C. H. Lindeman

Central Pennsylvania
Roy M. Cook

Delaware
Quentin C. Jurgensen

Philadelphia
Frank W. Convey

Rochester
Peter Hanson

Schenectady
Robert C. Spencer

Susquehanna
Dale F. Eyster

Syracuse
William C. Franklin

TUESDAY, OCTOBER 6

8:30 a.m.

Registration

9:30 a.m.

Machine Design (III)

Manufacture and Application of Toothed-Faced Clutches and Couplings, by *Ernest Wildhaber*, Gleason Works (Paper No. 53—F–14)

Machine-Design Problems—Before and After, by *Howard H. Langdon*, Curlator Corp. (Paper No. 53—F–15)

9:30 a.m.

Metal Processing (I)

Metal-Cutting Research in Great Britain, by *A. J. Chisholm*, United Kingdom Scientific Mission

Development of Test for Broaching Titanium and Its Alloys, by *R. E. McKee* and *W. W. Gilbert*, University of Michigan

Measurement of Superimposed Surface Finishes, by *Raymond E. Carroll* and *Norman Gortz*, Micrometrical Manufacturing Co.

9:30 a.m.

Fuels (I)

Cyclic Catalytic Reforming of Natural Gas, by *G. L. Calderwood*, Rochester Gas & Electric Corp.

Properties of Residual Petroleum Fuel, by *W. Sachs*, McGill University (Paper No. 53—F–1)

Coal and Ash-Handling Features—Milliken Station, by *H. C. Schweikart*, Gilbert Associates, Inc.

9:30 a.m.

Heat Transfer (I)

Erosion by Melting and Evaporation, by *Kurt Berman*, General Electric Co. (Paper No. 53—F–2)

Rapid Measurements of Thermal Diffusivity, by *G. E. McIntosh*, General Electric Co., *D. C. Hamilton*, Oak Ridge National Laboratories, and *Wilmer L. Sibbitt*, Purdue University (Paper No. 53—F–3)

12:15 p.m.

Joint Rochester Engineering Society and ASME Roy V. Wright Luncheon

Presiding: *Carl L. Bausch*, vice-president in charge of engineering and research, Bausch & Lomb Optical Co.

Speaker: *Carey H. Brown*, manager, engineering and manufacturing services, Kodak Park Works, Eastman Kodak Co.

Subject: **Engineering Manpower**

2:30 p.m.

Heat Transfer (II)

A Stable Numerical Solution for Transient Heat Flow, by *George Leppert*, Monsanto Chemical Co. (Paper No. 53—F–4)

Thermal Lags in Flowing Systems Containing Heat Capacitors, by *J. W. Ritska*, Glenn L. Martin Co. (Paper No. 53—F–8)

Calculation of Transient Temperatures in Pipes and Heat Exchangers by Numerical Methods, by *G. M. Dusinberre*, The Pennsylvania State College (Paper No. 53—F–6)

2:30 p.m.

Inspection Trips

Taylor Instrument Companies

Bausch & Lomb Optical Company

Gleason Works

2:30 p.m.

Power (I)

Design Considerations in Kodak Park's Power System, by *H. A. Decker*, Eastman Kodak Co. (Paper No. 53—F–9)

Design and Operation of High Recovery Regenerative-Type Air Preheaters, by *G. D. Braddon* and *Joseph Waitkus*, The Air Preheater Corp.

Centrifugal Boiler-Feed Pumps Under Transient Operating Conditions, by *Igor J. Karassik*, Worthington Pump Corp., *G. H. Bosworth*, Bechtel Corp., and *W. D. Elston*, Pacific Gas & Electric Co.

7:00 p.m.

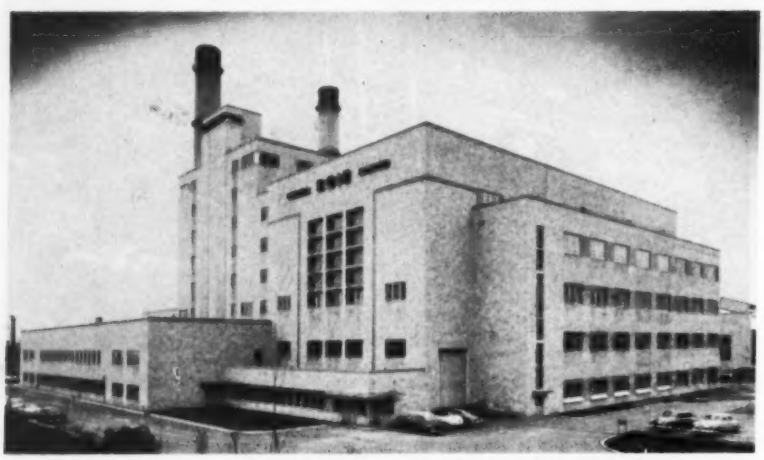
Banquet

Presiding: *Edward Peck Curtis*, vice-president, Eastman Kodak Company, Rochester, N. Y.

WEDNESDAY, OCTOBER 7

8:30 a.m.

Registration



ROCHESTER GAS & ELECTRIC CORPORATION

(Russell Station, among the plants to be visited, is one of the country's most efficient installations of power generation. It is located about eight miles north of Rochester on the south shore of Lake Ontario and comprises three units of an ultimate four-unit installation.)

9:30 a.m.

Fuels (II)—Safety (I)

Lighting-Off and Starting-Up Precautions for Stoker-Fired Boilers, by *Herbert W. Andrews*, Eastman Kodak Co.

Laboratory and Field Experience With Heating Oils, by *R. P. Gilmartin*, Gulf Oil Corp.

Installation of Fuel-Gas Piping on Premises of Industrial Consumers, by *E. L. Spanagel*, Rochester Gas & Electric Corp.

9:30 a.m.

Management (I)

Panel: **What Are the Specifications for an Effective System of Standard Data?**

Speakers: *William Gomberg*, director, management-engineering dept., International Ladies' Garment Workers Union, New York, N. Y., and *Dickey Dyer*, business manager, Work Factor Co., New York, N. Y.

9:30 a.m.

Power (II)

Design and Operation of Russell Station, by *Irvin G. McChesney*, Rochester Gas & Electric Corp.

Turbine Starting and Loading Tests at Dunkirk Station, by *R. C. Wiley* and *S. M. Kraiz*, General Electric Co.

9:30 a.m.

Education

Education in a Free Society, by *F. J. Stanford Smith*, *General Electric Co.*, *Morey J. Wantman*, University of Rochester, and *C. E. Harrington*, Winfield H. Smith Corp.

2:30 p.m.

Instruments & Regulators

Study for Cubic Characteristics Equation by Root-Locus Methods, by *Yaohan Chu*, Ford Motor Co.

The Study of Transients in Linear Feedback System by Conformal Mapping and the Root-Locus Method, by *Victor C. M. Yeh*, Gulton Manufacturing Corp. (Paper No. 53—F–7)

Static-Flow Characteristics of Single and Two-Stage Spring-Loaded Gas-Pressure Regulators, by *A. S. Iberall*, Aero Equipment Corp. (Paper No. 53—F–5)

2:30 p.m.

Management (II)

Standard Data Problems and Solutions, by *Gerald Nadler*, Washington University

The Theory and Practice of Standard Data, by *Adam Abruzzi*, Stevens Institute of Technology

Activity Sampling and Analysis—Its Theory and Practice, by *Harold O. Davidson*, The Johns Hopkins University (Paper No. 53—F–12)

2:30 p.m.

Inspection Trips

Eastman Kodak Company, Kodak Park Works

Mixing Equipment Company, Inc.

Pfaudler Company

Rochester Gas & Electric Corp. Russell Station

Women's Program

Sunday, Oct. 4

8:00 p.m.

Get-Acquainted Party

Monday, Oct. 5

8:45 a.m.

Kodak Park Tour. Kodak Park is the largest plant in the world manufacturing photographic materials and accessories, besides producing vitamins and over 3000 chemicals. The tour will consist of a trip through the roll-film division where, among other things, dark-room operations will be observed. There will also be a bus trip covering the complete 453 acres of buildings which comprise the Kodak Park Works. The trip will

BAUSCH & LOMB'S NEW EYEGLASS LENS PLANT

(ASME Members will see scores of new machines and revolutionary processes when they tour Bausch & Lomb Optical Company's new single-vision eyeglass lens plant during the Rochester meeting, Oct. 5–7. The unique high-speed semiautomatic processes were designed and built solely by engineers at the optical firm which is celebrating its 100th anniversary this year. The tour includes the firm's glass plant which produced over six million lb of optical glass for military optical instruments during World War II.)

end with luncheon in the Kodak Recreation Building service dining room.

1:00 p.m.

Bus Tour of the City. Leaving Eastman Kodak after luncheon the tour will go down to and along the shore of Lake Ontario to Durand-Eastman Park. Leaving Durand-Eastman Park, pass through the residential and commercial sections to Cobbs Hill Park for a bird's-eye view of the City. From there to Highland Park, famous for its lilacs, passing Colgate Divinity School and Strong Memorial Hospital to the University of Rochester river campus. Several world-famous industries will be passed, such as Bausch & Lomb Optical Company. The tour will end at Eastman School of Music for a brief trip through the school, one of the finest in the country. Tea will follow at the Rochester Club directly across the street from the Sheraton Hotel, meeting headquarters.

8:00 p.m.

An Evening at the George Eastman House. Eastman House is the former home of George Eastman, now converted into the only museum in the world devoted to the history of photography and the furthering of photography as an art and science. It contains one of the world's most complete collection of cameras, lenses, photographic apparatus, and materials both for stills and moving pictures, besides the Eastman collection of master paintings.

Tuesday, Oct. 6

9:30 a.m.

Letchworth State Park. The park extends for 17 miles along both sides of the spectacular Genesee River Gorge and is considered one of the most notable examples of scenic splendor in the United States. The gorge, often called the "Grand Canyon of the East," is nearly 600 ft high in some places. The park's 10,600 acres are usually ablaze with scarlet and gold the first week in October. One of the points of interest in the park is the new Federal flood-control dam. Luncheon will be served at Glen Iris Inn, home of the late William P. Letchworth, who gave the initial 1000 acres for the park.

7:00 p.m.

Banquet at the Hotel Sheraton

Wednesday, Oct. 7

9:30 a.m.

A style show will be staged and brunch served at Sibley, Lindsay and Curr Co., one of the oldest department stores in Western New York, now observing its 85th anniversary.

1:00 p.m.

Rochester ladies will be at headquarters to take anyone who desires to other points of interest in the city such as the Susan B. Anthony house, the Memorial Art Gallery, and the Bausch Museum.

Industrial Leader Says Shortage of Engineers Can Be Met

WITHOUT minimizing the actual and potential shortage of engineers for industry, Ralph L. Wilson, Mem. ASME, president, American Society for Metals, told a group of technical teachers, industrialists, and other scientists that the emphasis on "engineers" should be shifted to emphasis on "engineering."

The occasion was the first organized teachers' course in metals technology and other technologies at the vocational or high-school level.

Mr. Wilson spoke at the banquet and special assembly of the summer session for technician-instructors held under the auspices of the American Society for Metals at the State Teachers College, Oswego, N. Y., on June 26, 1953.

Mr. Wilson pointed out that there is at the present time grave concern about the shortage of technical manpower in industry. He further pointed out, however, that this technical manpower does not necessarily represent only engineers. Yet the whole of manufacturing processes which requires this manpower is engineering.

"We in industry are seriously concerned about the time and effort being expended by top engineering personnel on the supervision and direction of those who are not now, but can be, trained for greater degrees of proficiency," Mr. Wilson stated.

While it is not possible to fill the present shortage of 40,000 engineers, it is, nevertheless, a practical move to give the engineers we now have greater opportunity for doing their job. In other words, Mr. Wilson points out that with the training of technicians such as will be enrolled next fall under the faculties gathered at this meeting for special training, the shortage will automatically be reduced through the release of engineers for top engineering jobs.

While the Oswego summer session for technicians is unique in this country, it is by no means a strange operation in Russia.

Russia's present engineering schedule shows that they will graduate 120,000 engineers and 347,000 technicians.

It is clearly up to our educational systems, according to Mr. Wilson, to organize and carry forward special training for teachers in the skilled and technical fields.

Mr. Wilson's viewpoint reflects long experience in this field of engineering and the utilization of engineering manpower. He is at present director of metallurgy, Timken Roller Bearing Company, Canton, Ohio.

"To my mind this summer session for teacher specialization marks a true milestone in our national progress," he said. "America truly has the responsibility for...leadership and this teacher training...is a loud and positive assertion that their leadership will help the world find its way out of ignorance, despair, poverty, and fear into a prosperous freedom."

ASME Membership as of June 30, 1953

Honorary Members	50
Fellows	387
Members	13,638
Associates	339
Juniors (33 and over)	3,392
Juniors (30–32)	2,002
Juniors (to the age of 29)	17,463
Total	37,271

SES Executive Says Standardization Program Keeps Production Costs Low

NOW, as never before, purchasing and engineering must work together to keep down the company's cost of production, Vincent de P. Goubeau told the Standards Engineers Society at its annual meeting. Mr. Goubeau is vice-president in charge of materials, Radio Corporation of America, RCA Victor Division. The meeting was held at the Johnny Victor Theatre, New York, N. Y., June 11.

Warning purchasing agents that they must not stand in the way of engineering progress, Mr. Goubeau emphasized that the purchasing agent can frequently bring information about low-cost substitutes to the attention of the engineering department. These substitutes may be as suitable as the original, or even more so, he said.

The efficient purchasing agent today is becoming increasingly conscious of the importance of keeping costs down through use of standard items instead of specials, Mr. Goubeau declared. He knows that a product can be priced out of competition unless his company has an effective standardization program; both for the materials and parts that go into the company's product, and in that nonproductive area of a company's operations that supports production. When engineering calls for special items, the purchasing agent is in a position to bring current information on costs, availability, and performance of standard items to the attention of the engineer. The purchasing agent must look to the standards engineer for scientifically planned standards that make specials unnecessary, he said.

The committee method of arriving at standards offers an opportunity for free discussion. Mr. Goubeau believes this method helps to bring about general acceptance of standards and minimize objections to them.

The President's Page

Let's Keep Our Eye on the Ball

FROM time to time our Society is taken to task, both publicly and privately, on grounds which seem to us strange indeed, namely, that "the ASME traditionally stays clear of anything smacking of politics."

The criticism itself is more important than the merits of any single controversy generic to it. Should the engineering societies, in fact, take sides on questions of nontechnical character which are politically controversial? The question is raised with increasing frequency, especially by those who believe that since conditions of work, control of production, economic planning, and governmental activities in the technical field affect engineers, ASME should adopt a position on them.

The American Society of Mechanical Engineers, according to its charter, is a society for the advancement of the *arts and sciences* related to mechanical engineering. In performing that task to the best of our ability, we deem it our duty to serve *all* of our members and *all* of the public—not just Democrats or Republicans, employers or employees, free enterprisers, or disciples of the planned economy, albeit all of these schools of thought and many others may be represented in our roster of membership.

Engineering, like art, medicine, and the pure sciences, should avoid, by very design and intent, political entanglements of every character, except where scientific integrity itself is at stake, and then only on the basis of demonstrable facts. For example, ASME very properly might rise to protest if some legislator should threaten to establish the value of π as exactly 3.1, on the basis that it was foolish to bother with the extra decimals. (Comparable laws actually have been passed!) But we submit that questions of politically controversial character are not within our province.

To those who feel otherwise, we commend a reading of the basic laws and charter of this Society. We are not a trade association; we are not a labor union; we are not a political party; although judging from the mail we receive, we are expected at one time or another to be all three! The propriety of every proposal for the focusing of ASME activity on a new field of endeavor should be judged strictly in the light of the Society's objectives as defined in the Charter and Constitution. In abbreviated form they are simply these:

To promote the arts and sciences in our field
To encourage research
To foster engineering education
To advance the standards of engineering
To provide contact and discussion among engineers and scientists
To broaden the usefulness of our profession.

To these purposes we direct our energies and our enthusiasm, actively, continuously, vigorously, and, we earnestly hope, intelligently.

Our founding fathers were wise in their construction of our frame of reference. We shall be wise to keep within it. It is no accident that, on those rare occasions when, through misguidance or bad judgment, we step off the reservation, we usually find ourselves in hot water, our house divided against itself. The real opportunity which ASME offers its members for participation in both private and public affairs is to assist them in becoming better-informed, more articulate, and more competent engineers.

If ASME can do a creditable job in promoting these ends, it will have been true to its aim and destiny. This is not to say that its members, as individuals, should not take forthright positions with reference to the political questions of the hour. The record is full of evidence that they do. But that is not the purpose to which the Society owes its existence. In addressing itself to the task assigned to it, to the complete exclusion of political logrolling, our Society is acting in the best engineering and scientific tradition.

FREDERICK S. BLACKALL, JR., *President*
The American Society of Mechanical Engineers

National Conference on Industrial Hydraulics to Be Held in Chicago

THE program for the ninth National Conference on Industrial Hydraulics to be held at the Sheraton Hotel, Chicago, Ill., Oct. 8 and 9, has been announced.

John T. Rettaliata, Mem. ASME, president of Illinois Institute of Technology, will welcome the conference in behalf of the conference sponsors, Armour Research Foundation and Illinois Tech. After the opening remarks, papers on various phases of industrial hydraulics will be presented.

The general session will be led off by W. P. Green, Armour Research Foundation, who will present a paper on "Friction and Wear Phenomena."

The automotive session will consist of papers on "Hydraulics Applied to the Automobile Suspension," by R. R. Peterson, Chrysler Corporation, Detroit, Mich.; and "Hydraulic Mechanisms for Operating Auto-Window Lifts, Convertible Tops, and Similar Mechanisms," by C. L. Kalitta, Warner Division, Detroit Harvester Company.

E. V. Crane, Mem. ASME, and W. R. Jackson, E. W. Bliss Company, Canton, Ohio, will present their answers to "Hydraulic Problems on Large Forging Presses." Finishing the presses session will be a paper by A. J. DeMatteo, Mem. ASME, Watson-Stillman Company, Roselle, N. J., "Self-Contained Pump Units as Applied to Extrusion Presses."

"Boiler Feed Pumps," by O. M. Kristy, Allis-Chalmers, Milwaukee, Wis.; and "Ball Piston Pumps and Motors," by H. Stern, Jun. ASME, and W. T. Rauch, General Electric Company, Schenectady, N. Y., will comprise the pumps session.

John Pelz, Bendix Aviation Corporation, South Bend, Ind., will present his findings on "Aircraft Variable Delivery High-Pressure Fuel Plunger Pump" to the aircraft session.

Components session discussions will be on "Fluid Carriers for Hydraulic Units in Earth-Moving Equipment," by John Jass, Caterpillar Tractor Company, Peoria, Ill., and "Factors in Design of Mechanical Seals and Applications to Hydraulic Equipment," by Justus B. Stevens, Jr., and Harold Greiner, Sealol Corporation, Providence, R. I.

Machine-tools session papers will be: "Hydraulically Operated Test Table With Three Degrees of Freedom," by G. F. Warnke and S. Hori, Armour Research Foundation; and "Hydraulic Applications in Paper and Paper Processing," by Ranson Tyler, The Oilgear Company, Milwaukee Wis.

"Industrial Application of Nonflammable Hydraulic Fluids," by D. Milne, General Motors Corporation, Detroit, Mich.; and "The Effect of Synthetic Fluids on Hydraulic Components and Circuits," by James Robinson, Mem. ASME, Vickers, Inc., Detroit, Mich.; will be the two papers read during the nonflammable-fluids session.

Papers telling of the "Hydraulic System of the Golden Jubilee Ford Tractor," by Harold Brock, Ford Motor Company; and "Hydraulic Actuation of the TD-24," by W. W. Henning, Mem. ASME, International Harvester Company, Melrose Park, Ill.; will comprise the tractors session.

The instrumentation session will consist of papers on, "Pressure Transducers," by R. E. Boyar, Jun. ASME, Askania Regulator Company, Chicago, Ill.; and "A Flowmeter for Measuring Mass Flow-Rate With High Speed of Response," by Dr. Yao Tzu Li, Massachusetts Institute of Technology, Cambridge, Mass.

Societies that help Illinois Tech stage the conference each year include: The Illinois section of the American Society of Civil Engineers, Chicago section of The American Society of Mechanical Engineers, Chicago section of the Society of Automotive Engineers, Western Society of Engineers, American Society of Lubrication Engineers, Chicago section of the American Institute of Chemical Engineers, Chicago section of the Institute of Aeronautical Science, American Society of Agricultural Engineers, Chicago chapter of the Illinois Society of Professional Engineers, and the Chicago chapter of the American Society of Tool Engineers.

IRD to Hold Conference in Chicago, Sept. 22-23

A SYMPOSIUM on "Production Weighing and Control" has been planned by the Application Committee of the Instruments and Regulators Division of The American Society of Mechanical Engineers for presentation at the Eighth National Instrument Conference and Exhibit sponsored by the Instrument Society of America, to be held in Chicago, Ill., Sept. 21–25, 1953. All technical sessions will be held in the Morrison Hotel and the ISA exhibit will be held in the Sherman Hotel.

The IRD symposium will cover many phases of the weighing and control of materials. Since the sessions will be held in the Morrison Hotel, the IRD is planning to use this hotel as their headquarters.

The tentative IRD program for technical sessions is as follows:

TUESDAY, SEPTEMBER 22

Symposium on Production Weighing and Control

9:30 a.m.

A Buoyancy-Type Liquid Metering Unit, by *Wilder C. Stickney,* Blow-Knox Co.

High-Speed Weighing, by *N. G. Maloney,* E. I. du Pont de Nemours & Co., Inc.

Continuous Weighing Meters and Feeders, by *J. O. Kirwan* and *L. E. Demler,* Wallace and Tiernan Co., Inc.

Continuous Gravimetric Proportioning Systems, by *R. P. Lowe,* Proportioneers, Inc.

2:30 p.m.

Processing and Proportioning Materials by Weight, by *Enrico Klein,* Richardson Scale Co.

Batch Weighing for Process Control, by *Alfred H. McKinney,* E. I. du Pont de Nemours & Co., Inc.

Solids Flow and Level Measurement by Continuous Weighing, by *Robert H. Berg,* Process Control Services Co.

A Proportioning Batch Meter, by *L. E. Mylting,* The Allen-Sherman-Hoff Co.

WEDNESDAY, SEPTEMBER 23

9:30 a.m.

Electronic Weight Determination as a Tool for Control and Measurement Procedures, by *Verne C. Kennedy,* Streeter-Amet Co.

Electric Weighing Applications in Steel-Mill Processes, by *R. J. Carleton, Jr.,* Gilmore Industries, Inc.

Strain Cell Weighing, by *Lee Barnette,* Hercules Powder Co.

Remote Weight Measurement by Means of Hydraulic Load Cells With Electrical Transmitters, by *Joseph J. Hicks,* The Chemstrand Corp.

2:00 p.m.

Characteristics of Components in Pneumatic Weighing Systems, by *John W. Milroy,* CDC Control Services, Inc.

Bourdon Tubes and Bourdon-Tube Gages, by *L. M. Van Der Pyl,* Rockwell Manufacturing Co. (To be presented by title only.)

Panel discussion: **Production Weighing and Control**

Plans for Joint ASEE-ECPD Meeting Under Way

THE plans for a joint meeting of The American Society for Engineering Education and the Engineers' Council for Professional Development, to be held at the Statler Hotel, New York, N. Y., are rapidly forming.

The theme of the meeting to be carried out in sessions, discussions, and symposiums is "Civilization Is Dependent Upon the Growth of the Engineering Profession."

The tentative schedule of events includes a series of ASEE meetings on Wednesday, October 14. On Thursday, October 15, there will be a conference in the morning, followed by a joint luncheon at which ECPD members and committee members will be welcome. Conferences and committee meetings are arranged for the afternoon of October 15. ECPD will meet at 7:30 p.m. on Thursday for accrediting actions. At 8:30 the meeting will be opened and committee reports will be received and, society reports will be received by title, placed in the record.

On Friday, October 16, open sessions are scheduled. The morning meeting will be a dramatization of accrediting, bringing in representatives of the National Commission on Accrediting, the Middle States Association, and representatives of law, medicine, and other professions.

At the joint ECPD-ASEE Luncheon on Friday the speaker will be General A. G. L. McNaughton, chairman of Canadian Section of International Joint Commission, who will speak on "Water Problems of the Canadian Boundary." The afternoon session will be devoted to a symposium on future requirements of engineers. That evening the ECPD-ASEE dinner will be the occasion for the chairman to present his report. The speaker will be announced in the September issue of MECHANICAL ENGINEERING. Saturday, October 17, will be utilized for the organization of new committee work.

NSPE Acts on Unity

TOO many unresolved problems is the reason given by the National Society of Professional Engineers' Board of Directors for failing to accept, at this time, the Engineers Joint Council's invitation for the society to

join that group. The Board called for representatives of NSPE to offer to meet, as soon as possible, with representatives of EJC to discuss new approaches to unity of the engineering profession. John D. Coleman, president, NSPE, pointed out that an early meeting is desirable in view of NSPE's next Board Meeting to be held in November, at which time the NSPE Board will further consider the question. The decision was made at NSPE's nineteenth annual meeting in Daytona Beach, Fla., June 18–20, 1953.

The Board pointed out that unity of the profession is of paramount importance, but that the means for accomplishing it needed further clarification. Board members stated that more information was necessary concerning such items as individual membership in the enlarged EJC; the function of NSPE as a member; the degree to which NSPE's programs would be affected; and similar matters of concern.

The recently reorganized EJC has extended invitations to several engineering societies, one of which was NSPE, to become members. NSPE has had an observer at meetings of the proposed unity group since that time.

The enlarged EJC is a direct result of deliberations of an Exploratory Group for Unity of the Engineering Profession. The group was composed of representatives from leading engineering societies, and considered four plans that could lead to greater unity. The group, of which NSPE was a member, met over a period of about two years, to give careful consideration to this question.

ASME Reports on the Viscosity and Density of Lubricating Fluids

RECENT experimental work has resulted in comprehensive data on the viscosity and density of more than 40 lubricating fluids at temperatures from 32 to 425 deg F and at pressures up to 150,000 psi.

These new data are presented in two volumes entitled "Pressure-Viscosity Report" issued by the Research Committee on Lubrication of The American Society of Mechanical Engineers. Copies of the Pressure-Viscosity Report may be obtained at $10 the complete copy from the Research Department of The American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y.

The research which produced this report was a truly co-operative effort. The Research Committee on Lubrication determined the desirability of the program and made specific proposals for it. Twenty-seven industrial concerns provided financial support for the project. An Advisory Board composed of experts from universities, government laboratories, and the petroleum, synthetic lubricant, and equipment building industries contributed their services to insure representative selection of test fluids and to advise on the conduct of the experimental work. Petroleum and government laboratories made physical and chemical inspection tests on the fluids to insure that all fluids tested were properly identified. The pressure-temperature-viscosity-density measurements were carried out at Harvard University under the direction of R. V. Kleinschmidt.

The pressure-temperature-viscosity-density portions of the data have been entered on IBM punch cards and sets of these cards may be obtained from the ASME Research Department at a nominal charge.

It is considered that the data presented in this report will be of value for many years and will be subjected to many analyses in connection with lubrication problems—methods of expressing the variation of viscosity and density with pressure and temperature, and in correlation of these properties with the composition of lubricating fluids. Small quantities of many of the fluids are stored in sealed ampules for future reference or testing if such is needed.

The Research Committee on Lubrication is considering additional work in the analysis and correlation of the data and on practical lubrication tests on fluids of widely differing pressure-viscosity characteristics.

Steam Contamination

FIVE papers on the subject of steam contamination were presented at the 1951 ASME Annual Meeting under the sponsorship of the Joint Research Committee on Boiler Feedwater Studies. These, along with the discussions and authors' closures, have been assembled under one cover and can be obtained from ASME. The papers review some of the latest developments and results of research work in various phases of steam contamination such as silica measurement, the solubility of silica in steam, steam sampling, and the separation of steam and water in boiler drums. This symposium includes the following papers:

(1) Correlation of Silica Carry-Over and Solubility Studies (Paper No. 51—A-91), by C. Jacklin and S. R. Browar
(2) The Spectrophotometric Determination of Small Amounts of Soluble Silica in Water (Paper No. 51—A-92), by H. E. Robison, E. A. Pirsh, and Elizabeth J. Grimm
(3) Adaptation of the Spectrophotometric Determination of Small Amounts of Soluble Silica in Water to the Determination of Undissolved Forms of Silica (Paper No. 51—A-93), by H. E. Robison, Elizabeth J. Grimm, and C. Brown
(4) Field Testing of Steam-Sampling Nozzles as Applied to Evaporator Vapor (Paper No. 51—A-94), by E. B. Morris
(5) Influence of Boiler Design and Operation Conditions on Steam Contamination (Paper No. 51—A-95), by P. M. Brister, F. G. Raynor, and E. A. Pirsh

This collection of papers, a valuable source of information for all those interested in the general subject of steam contamination, costs $2. Send remittance to the Research Department of The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

Meetings of Other Societies

Aug. 17–19
Society of Automotive Engineers, international West Coast meeting, Georgia Hotel, Vancouver, B. C., Can.

Sept. 1–4
American Institute of Electrical Engineers, Pacific general meeting, Hotel Vancouver, Vancouver, B. C., Can.

Sept. 3–17
Nineteenth Engineering, Marine, and Welding Exhibition and the Chemical Plant Exhibition, Olympia, London, England.

Sept. 6–11
American Chemical Society, 124th national meeting, Hotel Conrad Hilton, Chicago, Ill.

Sept. 7–17
Fourth International Aeronautical Conference, sponsored by Institute of the Aeronautical Sciences and Royal Aeronautical Society, London, England

Sept. 7–10
ISO/TC 4/SC 1, Ball and roller bearings/Radial bearings (except taper roller bearings), Göteborg, Sweden

Sept. 14–16
ISO/TC 4, Ball and roller bearings, Göteborg, Sweden

Sept. 13–16
American Institute of Chemical Engineers, California meeting, Fairmont and Mark Hopkins Hotels, San Francisco, Calif.

Sept. 13–16
The Electrochemical Society, fall meeting, Ocean Terrace Hotel, Wrightsville Beach, N. C.

Sept. 13–24
Instrument Society of America, first international instrument congress and exposition, Philadelphia, Pa.

Sept. 14–15
American Hot Dip Galvanizers Association, semi-annual meeting, Statler Hotel, Cleveland, Ohio

Sept. 14–17
Illuminating Engineering Society, 45th national conference, Hotel Commodore, New York, N. Y.

Sept. 14–17
French Institute of Industrial Design, international congress of industrial design, Maison de la Chimie, Paris, France

Sept. 17–19
National Education Association of the United States, eighth national conference, Statler Hotel, Washington, D. C.

(ASME Calendar of Coming Events, see page 674)

People

1953 Academic Honors

At many college and university commencements honorary degrees were conferred on members of the Society. The list includes the following: JAMES C. WHITE, Mem. ASME, LLD, Brown University; HARRY A. KULJIAN, Fellow ASME, DE, Drexel Institute of Technology; SIDNEY H. BINGHAM, Mem. ASME, LLD, Fordham University; CLARENCE D. HOWE, Hon. Mem. ASME, DE, Northeastern University; LIVINGSTON W. HOUSTON, Mem. ASME, DE, Polytechnic Institute of Brooklyn; LILLIAN M. GILBRETH, Hon. Mem. ASME, DE, Princeton University; EARL F. ENGLISH, Mem. ASME, DE, Stevens Institute of Technology; and AUGUSTE G. PRATT, Mem. ASME, DE, Stevens Institute of Technology.

THOMAS R. REID, Assoc. ASME, was named assistant director in charge of manpower planning when the Office of Defense Mobilization was transformed from a temporary into a permanent Government agency.

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WILLIAM C. FOSTER, Mem. ASME, former Deputy Secretary of Defense, was chosen as the first full-time president of the Manufacturing Chemists Association at its annual meeting held at White Sulphur Springs, W. Va., June 11.

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THOMAS E. MILLSOP, president, Weirton Steel Company, Weirton, W. Va., was recently named the 1953 Gantt Medalist. Formal presentation of the medal will be made during the 1953 ASME Annual Meeting.

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LESLIE C. BEARD, JR., assistant director of Socony-Vacuum Laboratories, was elected president of the American Society for Testing Materials, at the fifty-sixth annual meeting of the society held June 28–July 3, in Atlantic City, N. J.

Authors of outstanding technical papers presented at previous ASTM meetings received awards. They are EVAN A. DAVIS and MICHAEL J. MANJOINE, Members ASME, recipients of the Charles B. Dudley Medal. To WILLIAM N. FINDLEY, P. G. JONES, R. L. SUTHERLAND, Mem. ASME, and W. I. MITCHELL went the Richard L. Templin Award; KATHARINE MATHER got the Sanford E. Thompson Award; and J. R. McDOWELL, the Sam Tour Award.

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R. E. PETERSON, Fellow ASME, and JEROME STRAUSS, Mem. ASME, were among the ten technical leaders in the field of engineering materials who received ASTM Awards of Merit.

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CALVIN D. ALBERT, Mem. ASME, emeritus professor of machine design, Cornell University, represented the Society at the Thurston and Kimball Halls dedication ceremonies held June 13 on the Cornell campus.

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JOHN A. NEALE, Mem. ASME, was elected president of the Society of Fire Protection Engineers, at the annual meeting of the society recently held at the Palmer House, Chicago, Ill.

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A. A. POTTER, Hon. Mem. ASME, was the recipient of the 1953 Cyrus H. McCormick Gold Medal which was presented by the American Society of Agricultural Engineers at the annual dinner held June 17 at the Hotel William Penn, Pittsburgh, Pa.

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H. D. CONWAY, Jun. ASME, professor of mechanics, Cornell University, was awarded a Guggenheim Fellowship. He plans to spend the coming academic year at the City & Guilds College, Imperial College of Science and Technology, London University.

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CARL F. MAYER, president, Carl-Mayer Corp., Cleveland, Ohio, was a recipient of the Trinks Award for outstanding achievement in the industrial-heating industry.

* * *

JOHN M. FERRY, Mem. ASME, former building engineer for the New York Telephone Company, has been appointed Special Assistant for installations to Under Secretary of the Air Force James H. Douglas, Jr.

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R. HARTLEY SHERWOOD, president, Central Indiana Coal Company, received the first annual award for outstanding leadership on behalf of industry-sponsored coal research presented by Bituminous Coal Research, Inc., during the 1953 annual meeting in Cincinnati, Ohio.

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FRANCIS H. HORN, executive secretary of the Association for Higher Education of the National Education Association, was elected as fourth president of Pratt Institute. He will assume his new post on Aug. 15, 1953.

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RODNEY D. CHIPP, director of engineering for the Du Mont Television Network, was elected president of the Technical Societies Council of New York, Inc.

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A. H. MANWARING, executive vice-president, Philadelphia (Pa.) Electrical and Manufacturing Company, was elected president of the Illuminating Engineering Society at the June Council meeting, in New York, N. Y.

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W. E. CAMPBELL, of Bell Telephone Laboratories, Murray Hill, N. J., was elected president of the American Society of Lubrication Engineers, at the annual meeting held in Boston, Mass.

G. C. DERRY HONORED

(*Left to right:* W. W. Sproul, Jr., Westinghouse vice-president, Pittsburgh, Pa., headquarters, presents the Westinghouse Order of Merit Citation to G. C. Derry, Mem. ASME, Sturtevant division manager, as H. E. Seim, vice-president and general manager, looks on.)

ASME Elects Five Fellows

THE American Society of Mechanical Engineers has honored five of its members by electing them to the grade of Fellow of the Society.

To be qualified as a nominee to the grade of Fellow one must be an engineer who has acknowledged engineering attainment, 25 years of active practice in the profession of engineering or teaching of engineering in a school of accepted standing, and has been a member of the Society for 13 years. Promotion to the grade of Fellow is made only on nomination by five Fellows or members of the Society to the Council, to be approved by Council.

The men whose outstanding contributions to their profession and to the Society were so honored are:

George Joseph Dashefsky

GEORGE J. DASHEFSKY, superintending engineer, head, Research and Technical Division, Material Laboratory, New York Naval Shipyard, Brooklyn, N. Y., has made important contributions to engineering in the field of vibration and engine dynamics. He has been with the Navy Yard since 1919. Mr. Dashefsky was awarded the Distinguished Civilian Service Award, the U. S. Navy's highest civilian award, for outstanding performance of duty as head of the Vibration and Engine Dynamics Section and as consultant on mechanical engineering and applied mechanics of the Navy's Material Laboratory during World War II. During that period he rendered distinguished service in designing, developing, and improving main-propulsion machinery of various types with particular regard to vibration characteristics. Under his direction many unusual assignments were executed including the successful solution of complicated vibration problems encountered in main propulsion and other naval machinery. He has held positions of increasing importance, becoming head of the Mechanics Branch of the Material Laboratory in 1949. The work of this Branch included the planning and operation of broad research and development programs directed toward improvement of main propulsion and other machinery, shipboard equipment, and materials. In 1951 he

was promoted to his present position where he is responsible for the organization, direction, and performance of a Division with 750 scientists, engineers, and technicians. The Material Laboratory, one of the Navy's largest employing about 1200 people, is highly diversified, engages in research and development work in shock and vibration, machinery-noise reduction, mechanical and electrical engineering, electronics, metallurgy, chemistry, nucleonics, and gyrodynamics. During the war he was a member of the Vibration Committee of the War Engineering Board under which he participated in the writing of two books, "Cooperative Testing of Torsiographs and Calibrators," 1946, and "Evaluation of Effects of Torsional Vibration," 1945. Author of several papers, Mr. Dashefsky in 1930 won the Rudolph Diesel Award of the ASME Oil and Gas Power Division for the best technical paper of the year, titled, "The Elimination of Torsional Vibration." He was presented the "OGP Award" in 1948 for his paper, "Improved Techniques in Study of Engine Firing Orders Using the Vectorscope." He is an active member of ASME. As a member of an ASME Committee he collaborated in the revision of the Power Test Code for Internal-Combustion Engines—1949. He has served on the Executive Committee of the Oil and Gas Power Division as associate and as a member since 1941. He is the present chairman of the Division. He holds several patents obtained through the Navy for vibration-damping devices and systems for controlling machinery vibration.

Harold Doust Kelsey

HAROLD D. KELSEY, manager of engineering, gas-turbine department, General Electric Company, Schenectady, N. Y., has made outstanding contributions to the development of the modern high-efficiency steam turbines. Mr. Kelsey has been with General Electric Company for over 30 years and during that period has worked in many different G.E. departments around the country. In his early work with G.E.'s turbine engineering department at Schenectady, he played an important role in the designing and testing of the first 1200-lb turbine unit. He was actively in charge of the installation in pioneer work at the Edgar Station of the Boston Edison Company. His work in this department included research, design, applications, operation, and manufacture of all types of turbines for generator and mechanical drive on all sizes. Mr. Kelsey served successively as designing engineer; mechanical drive turbine department; executive engineer, air-conditioning department; and engineer, air-conditioning and commercial-refrigeration department. As engineer of the General Electric supercharger plant at Fort Wayne, Ind., Mr. Kelsey contributed to the aircraft supercharger during World War II. After the war he performed an outstanding service in developing the TG-190 turbojet engine as managing engineer and manager of the G.E. aircraft gas turbine division. He became a member of ASME in 1930.

Paul Holland Knowlton

P. H. KNOWLTON, thermodynamic engineer, Turbine Division, General Electric Company, Schenectady, N. Y., has for the past 28 years been contributing to the design and improvement of General Electric steam turbines, with particular attention to their efficient performance. For many years Mr. Knowlton has been an important member of the G.E. team analyzing in detail the effective performance of every energy-converting element of turbine design with a view to its improvement, while at the same time striving to use the best possible theoretical cycles for power generation. Throughout the past 25 years the heat rates chargeable to the best turbines have been decreased from 10,300 to 7900 Btu/kwh, an improvement of 24 per cent. These improvements, together with more efficient boilers, have resulted in a 40 per cent reduction of the average coal rate of the United States from 2.0 lb/kwh to less than 1.2 at the present time. The economic importance of this can be appreciated when it is realized that it would now require approximately 100 million tons a year more fuel to generate present electricity usage in this country had these improvements not been made. Mr. Knowlton joined G.E. as a student engineer in 1925. For 13 years he headed the steam-research section of the turbine department and in 1944 he became assistant designing engineer. Before assuming his present position in 1949, he was assistant to the manager of engineering of the Turbine Division. Mr. Knowlton is a member of the ASME Power Test Code Committee, and the Finance Subcommittee of the Special Research Committee on Fluid Meters. He has had several papers published by ASME and holds several patents.

ASME Calendar of Coming Events

Sept. 21–25
ASME Industrial Instruments and Regulators Division and Instrument Society of America Exhibit and Joint Conference, Sherman Hotel, Chicago, Ill.
(Final date for submitting papers was May 1, 1953)

Sept. 28–30
ASME Petroleum Mechanical-Engineering Conference, Rice Hotel, Houston, Texas
(Final date for submitting papers was May 1, 1953)

Oct. 5–7
ASME Fall Meeting, Hotel Sheraton, Rochester, N. Y.
(Final date for submitting papers was June 1, 1953)

Oct. 29–30
ASME Fuels Division and AIME Coal Division Joint Conference, Conrad Hilton Hotel, Chicago, Ill.
(Final date for submitting papers was June 1, 1953)

Nov. 29–Dec. 4
ASME Annual Meeting, Statler Hotel, New York, N. Y.
(Final date for submitting papers was July 1, 1953)

March 10–12, 1954
ASME International Meeting, Hotel Del Prado, Mexico City, D. F.
(Final date for submitting papers—Nov. 1, 1953)

June 14–17, 1954
ASME Oil and Gas Power Conference, Hotel Muehlebach, Kansas City, Mo.
(Final date for submitting papers—Feb. 1, 1954)

June 20–24, 1954
ASME Semi-Annual Meeting, William Penn Hotel, Pittsburgh, Pa.
(Final date for submitting papers—Feb. 1, 1954)

(For Meetings of Other Societies, see page 672)

Anthony J. Nerad

ANTHONY J. NERAD, manager, mechanical-investigations section, Research Laboratory, General Electric Company, Schenectady, N. Y., has been active in engineering and research for the past 30 years. Since 1923 he has been connected with the Research Laboratory of General Electric Company. Much development work on mercury boilers for electric-power generation was done by him. This is said to be the most efficient known means so far developed for the generation of electric power from fuel. Mr. Nerad's ingenuity is responsible for the solution of many of the technical difficulties encountered in the boiling of mercury and its safe use in great central stations. During World War II, much of Mr. Nerad's work was connected with the problem of combustion, which had to be solved in jet and rocket propulsion, and which is more recently being devoted to the perfection of gas turbines for peacetime commercial and industrial uses. Mr. Nerad has been an active participant in technical society activities. He holds 15 patents on improvements in mercury boilers and generators and similar equipment.

Lee Schneitter

LEE SCHNEITTER, power plant engineer, Ebasco Services, Inc., New York, N. Y., is internationally recognized as an outstanding specialist and expert on diesel, gas-engine, and gas-turbine power plants. He has been responsible for the promotion and development of a large number of successfully operated diesel and gas-engine power plants both in this country and abroad. Mr. Schneitter has contributed greatly to the advancement of the internal-combustion engine. He is considered a leading authority in this country on diesel plants designed to operate on low-cost heavy fuel oils. His paper on 27 diesel plants is still recognized as containing the most valuable information ever collected on this subject. Mr. Schneitter's early work on the development of diesel plant-maintenance schedules formed a guide for maintenance programs now used by leading power-plant operators. His work on the Oil and Gas Engine Cost Committee aided in the development of methods for standardizing cost accounting and for the keeping of performance data and plant records. He has spent 32 years in the power-plant field. During ten years at the Electric Bond and Share Company of New York, he supervised design and engineering for over 200,000-kw of internal-combustion-engine generating stations in seven countries. He was also in charge of design of many utility diesel generating stations and gas pipe-line pumping stations in this country. Since 1935 he has been in charge of design and engineering of all types of internal-combustion-engine power plants at Ebasco Services, Inc. He has also made many studies and economic analyses. Mr. Schneitter has served on several ASME committees. An outstanding contribution has been his work on the ASME Power Test Code for Internal-Combustion Engines, now accepted by industry as standard for testing engines. He has written many valuable papers and is the author of a handbook, "Internal-Combustion Engine Plants—Applications and Power Costs," 1945.

1953 ASME Semi-Annual Meeting in Los Angeles Receives Enthusiastic Reception

APPROXIMATELY 2000 members and guests attended more than 50 technical sessions to hear and discuss over 150 papers on various subjects and phases of engineering; attend the social functions where leading engineers, industrialists, and government representatives spoke; and take the inspection trips to industrial plants in the area which were offered as the program of the 1953 ASME Semi-Annual Meeting of The American Society of Mechanical Engineers held at the Statler Hotel, Los Angeles, Calif., June 28–July 2, 1953. Several ASME committees also took advantage of this occasion to hold important meetings. The meetings and sessions of the American Rocket Society, an affiliate of ASME, and the Heat Transfer and Fluid Mechanics Institute engendered much interest and were well attended. Perennial features of the Semi-Annual Meeting, such as the meetings of the National Nominating Committee, the five-session meeting of the Council, and the business meeting, the Regional Delegates Conference, were also high lights of this meeting.

Lewis K. Sillcox Nominated for President

Lewis K. Sillcox, vice-chairman of the board of The New York Air Brake Company, was nominated for the office of President of ASME or the administrative year 1953-1954. Vice-presidents nominated were: Willis F. Thompson (renomination), Region I, vice-president, Westcott & Mapes, New Haven, Conn.; William G. McLean, Region III, professor, head of the department of mechanics, Lafayette College, Easton, Pa.; Thompson Chandler, Region V, chemical engineer, Carbide & Carbon Chemical Corporation, South Charleston, W. Va.; Vernon A. Peterson, Region VII, district manager for the Elliott Company, Los Angeles, Calif.; and Clifford H. Shumaker, Region VIII (for one year), director of the Institute of Management, Southern Methodist University, Dallas, Texas. Those nominated for Directors at Large are: Frank L. Bradley, plant engineer, Forstmann Woolen Company, Passaic, N. J.; and Robert B. Lea of the Sperry Corporation, New York, N. Y.

Brief biographies of these nominees will be published in the September issue of MECHANICAL ENGINEERING. Official ballots will be mailed to members later in the summer. The new officers will begin their terms at the conclusion of the 1953 ASME Annual Meeting to be held Nov. 29–Dec. 4, at the Statler Hotel, New York, N. Y.

1954 Nominating Committee Elected

At the brief business meeting which was held on June 29, it was announced that the 1954 Semi-Annual Meeting would be held June 20–24, at the William Penn Hotel, Pittsburgh, Pa. The Secretary read the nominations offered by the Regions for the National Nominating Committee for 1954. See page 680 of this issue.

President's Luncheon

The engineer's contribution to the community as a member of a professional society brings untold returns in welfare to his business and industry and in personal development, Frederick S. Blackall, jr., president of ASME, said at the President's Luncheon. He urged fellow members to find their place in the varied activities of the Society whose fundamental purpose is to broaden public service.

"One of the ASME's really great contributions to the public welfare, national defense, and the nation's industry, of which most engineers are a part, is the ASME program of Codes and Standards. It is often little known and understood except by those who carry on this important function," he stated. "For instance, engineers who worked on the development of the American-British-Canadian screw-thread accord cannot fail to realize that he has done something worth while, not alone for his industry or his country, but for the free world at large. The added security which a common screw thread brings to the defense of the free nations of the world cannot be measured in dollars or pounds . . . but in the lives and blood of men it will save.

"Or, consider the Society's contributions to public safety through such measures as the Codes for Boilers and Unfired Pressure Vessels. Who knows how many lives the Boiler Code has saved, or what destruction of property it has been the means of preventing! The financial savings to industry and government alike through the development of sound standards are immeasurable."

As to the question often asked whether the ASME concerns itself with civic and governmental affairs, Mr. Blackall said, "We do, within what we consider to be our frame of reference," citing appearances made by committees and other representatives of the Society before Congressional hearings on subjects relating to engineering and technical legislation.

Another contribution is through the Engineers' Council for Professional Development, of which the ASME is an active member, which raises the standards of engineering education through its rating system for professional engineering institutions of higher learning, he pointed out.

As to personal benefits, Mr. Blackall reminded, "One of the great needs of the engineer is to develop the power of expression, through both the written and spoken word. Discussion forums, programs, and public addresses offer him an opportunity to strengthen himself along these lines and to exchange ideas with other professional men of like interests. And, whoever questions the prestige of appearing on a technical program?"

Some 300 engineers are active in the 14 research committees of the society, while around 3000 are devoting their time and skill to the development of ASME Codes and Standards, he revealed.

PRESIDENT BLACKALL ADDRESSES LUNCHEON MEETING

Technical Program

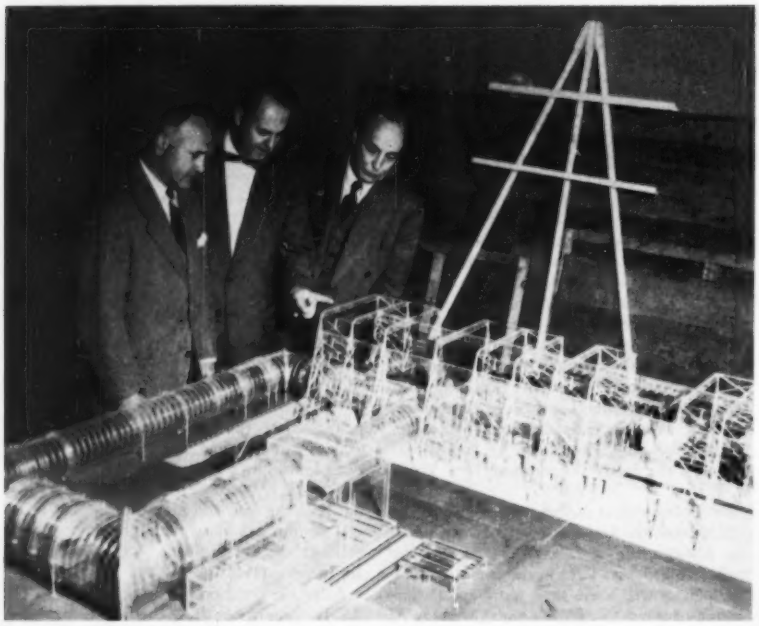
The 50 technical sessions for the four-day conclave, in which the 21 ASME Professional Divisions and Committees participated, were devoted to such various subjects as aviation, materials handling, machine design, and gas turbines, applied mechanics, management problems, production engineering, fuels, oil and gas power, and lubrication. More than 150 speakers, including prominent research, project, and production engineers, and university professors, addressed the engineers on such subjects as the development of ramjet power, turbocompressors, propulsion wind tunnels,

ASME Officers Nominated for 1954

MEMBERS of the ASME Nominating Committee for 1953, A. R. Weigel, *chairman*, K. P. Hanson, *secretary*, H. E. Harris, W. H. Byrne, G. M. Muschamp, W. A. Carter, R. S. Stover, and R. P. Lockett have nominated as directors of the Society for 1954 the following:

OFFICE	NOMINEE
President	Lewis K. Sillcox
Vice-President (for two years)	Willis F. Thompson, Region I (renominated)
	William G. McLean, Region III
	Thompson Chandler, Region V
	Vernon A. Peterson, Region VII
	Clifford H. Shumaker, Region VIII (for one year)
Directors at Large (for four years)	Frank L. Bradley
	Robert B. Lea

Biographical sketches of the candidates for office will be published in the September issue of MECHANICAL ENGINEERING.



TULLAHOMA PROPULSION WIND TUNNEL ON EXHIBIT AT ASME SEMI-ANNUAL MEETING

(C. M. Sandland, chairman of the Southern California Section and chairman of the 1953 ASME Semi-Annual Meeting, points out features of the Tullahoma propulsion wind tunnel to President F. S. Blackall, jr., *left*, and J. Calvin Brown, *right*, past-president and Fellow ASME, who was honorary chairman of the Semi-Annual Meeting.)

artillery rockets, the history of aviation, the smokeless burning of waste-process gases, and nuclear power plants.

One of the interesting features of the meeting was a wind-tunnel model made available to the meeting through the courtesy of the USAF and Westinghouse Electric Corporation.

The six sessions of the Heat Transfer and Fluid Mechanics Institute held in conjunction with and under the auspices of the ASME Heat Transfer Division at the Statler Hotel and at Founders Hall, University of Southern California campus, brought forth much important information on heat transfer in various applications, studies of shock wave, factors that influence heat transfer, Professor Moore's fluid-flow analogs for solving heat-conduction problems, cavitation, the theory of flame propagation, stability of heterogeneous systems, and evaporation from liquid-wall films into a turbulent gas stream.

Real progress has been made toward development of nuclear power plants for industrial use, said R. A. Bowman, Mem. ASME, addressing a technical session of the Power and Hydraulic Divisions. He said the external appearance of a nuclear power plant will resemble conventional coal or oil-fired plants, except that the boiler will be replaced by a building containing the reactor and steam generator. Fuels used, he added, will be Uranium 235, Plutonium, or Uranium 233. The heat released in fissioning one pound of uranium fuel is roughly equal to 1500 pounds of coal. No estimates are available yet as to cost of such a power plant but with suitable development the cost would be reasonable, said Mr. Bowman.

"Electronic computers will reduce production costs in manufacturing plants by speeding output of product and may replace clerical employees." So said Richard C. Canning, assistant research engineer, Industrial Logistics Research Project at the University of California, at a Management Division technical session. For receiving and processing orders the machines can replace clerks for writing, computing, sorting, and selecting production data. In addition the computer can store pertinent information, such as the progress of shop orders. In a plant producing $12 million of goods within $2\frac{1}{2}$ years the machine would increase output three per cent and save $535,000 by increasing efficiency.

Digests of ASME Semi-Annual Meeting preprints will be published in forthcoming issues of MECHANICAL ENGINEERING.

Luncheon Meetings

At the Petroleum Division Luncheon, A. C. Rubel, vice-president of exploration and production, Union Oil Company of California, spoke on "Petroleum's Place in Our Industrial Future." Optimistic concerning future petroleum resources, he warned that ". . . the current rate of petroleum production will decline within three years, if new reserves are not developed. Despite the largest oil reserve and the greatest daily production in our history, by 1955 the gap between current producibility and requirements will grow ever larger," he pointed out, "if these new sources are not developed." Mr. Rubel stated that current availability of petroleum products is 8,159,000 bbl daily of a total known producible reserve of approximately 30 billion bbl. Current production is 7,204,000 bbl daily, he noted.

Mr. Rubel challenged the mechanical engineers in his audience to design engines and other devices that will conserve fuel rather than waste it.

The Korean War has proved that power plants in United States airplanes need more development. This assertion was made by F. L. Wattendorf, Mem. ASME; John Noyes, project engineer, Sverdrup & Parcel, Inc., St. Louis, Mo.; and A. I. Ponomareff, Mem. ASME, when they described the Air Force Propulsion Wind Tunnel of the Arnold Engineering Development Center at Tullahoma, Tenn. The wind tunnel, the world's largest, designed to explore the performance of propulsion systems, including ramjet and turbojet for jet aircraft and guided missiles, will put the United States in the forefront of powerplant progress, asserted the engineers.

At the Aviation and Gas Turbine Power Luncheon at which R. Q. Roosman, Jun. ASME, presided, George H. Prudden, director of quality control, Lockheed Aircraft Corporation, Burbank, Calif., called for a return to "pinch-penny" ingenuity in airplane design.

GEORGE PRUDDEN OF LOCKHEED AIRCRAFT CORPORATION TALKS AT AVIATION AND GAS-TURBINE POWER LUNCHEON

"A large part of today's higher prices—and the even higher ones looming down the line—might be shaved by a return to early-day concepts of airplane design. Future economies may best come from some original engineering thinking, by discovery of tricks to simplify structural parts and their assembly," he said.

"In 1920 the first four all-metal planes were built for $200,000. The Ford Tri-Motor—most famous of early transports—and the forerunner of the modern transport airplane—sold for $55,000 and as little as $25,000. The reason for the low cost was design ingenuity." Modern designers would do well, he advised, to take a page out of the early pioneers' book. Mr. Prudden, with Lockheed since 1932, is a true aviation pioneer. He designed and built his first airplane at high-school age in 1910.

A high spot of the meeting activities was the American Rocket Society Luncheon at which Major C. E. Yeager, USAF, Edwards AFB, the first man to penetrate the sound barrier (to fly faster than sound), discussed his experiences in rocket-propelled aircraft.

L. A. DUBRIDGE, PRESIDENT, CALIFORNIA INSTITUTE OF TECHNOLOGY, SPEAKS AT BANQUET

Concurrently, at the Heat Transfer Luncheon, Benjamin Pinkel, Mem. ASME, gave a talk on "Summary of NACA Research."

Other features of the meeting were the Junior Forum, held Monday, June 29, and at which William F. Nash, Mem. ASME, gave a talk entitled, "The Future's Unlimited—Let's Get Ready."

Banquet

At the banquet, Dr. L. A. DuBridge, president of the California Institute of Technology, Pasadena, spoke on Science, Industry, and the Government. "Our nation *needs* science and engineering more than ever in its history," said Dr. DuBridge. "While engineers can be proud of the results of their work, the public does not fully understand the engineers' role. Too often the scientist and engineer is looked upon not as a patriotic citizen who helps preserve his country's freedom, but rather as a diabolical inventor of weapons of death. The major objective of scientists and engineers is to make the world a better place in which to live," he said. Dr. DuBridge warned against thinking of the scientist or engineer solely as a maker of weapons of war. He cautioned against the danger of suspension of research and development projects in educational institutions. He was introduced by J. Calvin Brown, past-president and Fellow ASME.

Inspection Trips

Six inspection trips were arranged during the meeting, which afforded ASME members and their guests an opportunity to see in operation such famous industrial plants as Lockheed Aircraft Corporation, with its fabulous "Hall of Giants," the final assembly lines of military and commercial planes inching up to completion. The French Sardine Company is the largest and most modern fish cannery anywhere. Tuna, sardines, and albacore are prepared for shipment all over the world. From this plant there is an especially beautiful view of Los Angeles Harbor. A group went to the Exchange Lemon Products Company, largest lemon-processing plant in the world. The modern processes and apparatus used by this company for the extraction of juices and the manufacture of lemon oil were viewed. Thirty per cent of the United States lemon crop is converted here into various products. The facilities of the C. F. Braun Corporation engineering and fabricating plant were inspected. Here were seen the million-dollar research laboratory, an engineering center consisting of some 900 offices, and a 12-acre manufacturing plant producing specialized process equipment. Lever Brothers Company's recently completed plant for the manufacture of soap products and food shortening, such as Lux and Lux Flakes, Lifebuoy Soap, Surf, Rinso, and Spry, was an interesting feature of the trip. The visit to Hyperion Treatment Plant showed how sewage sludge is treated for the City of Los Angeles and vicinity; affluent is rendered harmless for flow into the Pacific Ocean; solids are rendered commercially usable by ferric chloride process; and large batteries of gas engines generate power.

Women's Program

Sunday afternoon the Woman's Committee, with Mrs. George Ehrhart as chairman, was on hand to greet and register guests. Early Monday morning the Committee was there in full force and arranged for a trip by private cars to the beautiful new Greek Orthodox Saint Sophia Cathedral. A guide conducted the women around and explained some of the symbols.

The President's Luncheon followed the morning expedition and after this 90 women—each wearing an orchid corsage, gift of the local Committee—departed on buses for a tour of Universal-International Studio. They were thrilled to see, still existing, sets of old favorites—the Kentucky mansion used for Uncle Tom's Cabin, the Cathedral of Notre Dame for the Lon Chaney production, and many others. Many familiar names appeared on dressing-room doors. Trial shots were being made for television and on another lot preparations were being made for two forthcoming productions. Leaving the studio, the bus toured the Tuluca Lake section and the driver pointed out homes of several well-known actors and actresses. There was a stop at the Hollywood Bowl, the largest natural amphitheater in the world, and the site of the Easter Sunrise service and the summer evening concerts. The tour continued through Hollywood, over the Hollywood Freeway where the minimum speed limit is 55 mph, then back to the Statler.

On Tuesday morning the women visited The Farmers Market, where shopping for the necessities of everyday life, as well as the luxuries, becomes a charming "chore." Lunch was a delightful experience. In the afternoon a trip was scheduled to the Huntington Library and Art Gallery at San Marino, Calif. This beautiful library and museum was the residence of Henry Edward Huntington who accumulated a fortune in real estate in Southern California and willed the institution to a self-perpetuating Board of Trustees. The beautifully kept grounds contain a cactus garden with 2500 varieties, a palm collection, a rose garden, and an oriental garden with all the traditional ornaments. The Art Gallery houses many beautiful paintings, the best known being "The Blue Boy" by Gainsborough, and "Pinkie" by Lawrence. The Library is a mecca for research students and contains many rare books, documents, and manuscripts, two of the more famous ones being the Gutenberg Bible and the manuscript of Chaucer's "Canterbury Tales".

L. K. SILLCOX, *center*, PAUSES TO CHAT WITH FRIENDS

On Wednesday a group went on an all-day outing to Knott's Berry Farm. Begun humbly as a berry stand, the place has grown into a museum of the Old West. A delicious dinner was served.

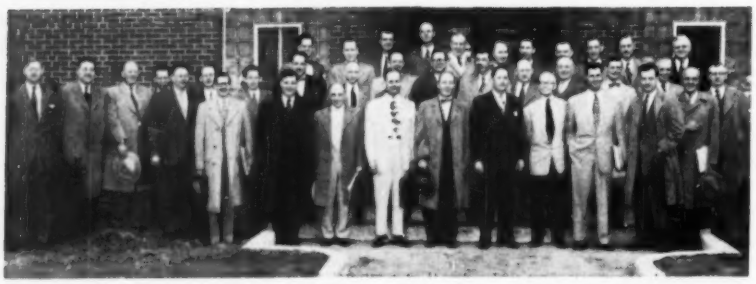
Committees

The committees in charge of arrangements for the Semi-Annual Meeting included the following: *General Committee*, C. M. Sandland, *chairman;* R. F. O'Mara, *vice-chairman; Technical Events*, J. S. Newton, *chairman; Printing and Signs*, J. R. Phares, *chairman;* S. Bucksbaum, H. N. Haight, H. M. Hamm, and W. F. Helmich, Jr.; *Hotel*, R. M. Hatfield, *chairman;* J. Falcon, C. O. Giles, G. E. Hallen, and R. F. Krause; *Entertainment*, A. Dahlstrum, *chairman; Inspection Trips*, M. A. Wise, *chairman;* E. Bladholm and W. H. Halpenny; *Information and Registration*, W. J. King, *chairman;* D. Brimley, L. Hamilton, O. Jacobsen, and J. J. Martin; *Publicity*, Norman Lynn, *chairman;* C. O. Giles; *Reception*, V. A. Peterson, *chairman;* P. L. Armstrong, *vice-chairman;* F. Jennings and L. Leonard; *Women's Activities*, Mrs. George Ehrhart, *chairman;* Mrs. P. L. Armstrong, Mrs. S. F. Duncan, Mrs. H. L. Eggleston, Mrs. V. A. Peterson, and Mrs. Edward Timbs; *Finance*, I. E. Sage, *chairman;* George Ehrhart and C. H. Smith.

ASME Regional Administrative Committees Held

REGION I, WORCESTER, MASS.

REGION II, NEW YORK, N. Y.



REGION III, PHILADELPHIA, PA.

REGION IV, GAINESVILLE, FLA.

Meetings In March, April, and May

REGION V, CHARLESTON, W. VA.

REGION VI, ROCKFORD, ILL.

REGION VII, PHOENIX, ARIZ.

REGION VIII, NEW ORLEANS, LA.

1953 ASME Regional Delegates Discuss Society Affairs at Los Angeles, June 28-29

RECOMMENDATIONS of the ASME Regional Delegates Conference, which met at the Statler Hotel, Los Angeles, Calif., June 28-29, during the 1953 ASME Semi-Annual Meeting, were reported to the Council at the conclusion of the conference and have been passed on to appropriate ASME committees for study and suggested action. After the committees have completed their studies and have reported on them, the Council will take appropriate action and prepare a report of the final disposition of every recommendation.

Through the Regional Delegates Conference members of ASME have an opportunity to discuss Society affairs and have a voice in procedures which bring matters of importance to them to the attention of the Council in an orderly manner. Each conference elects an Agenda Committee whose duty it is to assemble from members and sections subjects and suggestions on which action is desired. These agenda items are discussed and acted upon at meetings of the eight Regional Administrative Committees, held in the spring, consisting of representatives of sections of each Region. Each Region sends two delegates, a senior and a junior delegate, to the conference held at the time of the Semi-Annual Meeting. Here the agenda items are discussed by the delegates and the final recommendations are prepared for submission to the Council.

The speaker of the 1953 conference was J. C. Jefferds, Jr. G. W. Beesley, vice-speaker, was temporarily seated as secretary due to the absence of R. S. Harper who could not attend the conference. The Regional Delegates who attended the conference were as follows (the first name given in each case is that of the senior delegate and the second, that of the junior delegate):

Region I: C. E. Crede and D. A. Fisher
Region II: E. S. Rowell and W. S. Johnston
Region III: R. G. Tessmer, Sr., and R. W. Worley
Region IV: A. C. Ormond and John W. Little
Region V: J. C. Jefferds, Jr., and A. B. Heiberg
Region VI: R. W. Mills and R. D. Teece
Region VII: R. E. Wiegand and R. L. Johnson
Region VIII: G. W. Beesley and C. W. Crawford.

The 1953 Agenda Committee consisted of W. H. Byrne, chairman, and L. S. Whitson.

The following were officers for the 1953 Regional Delegates Conference: J. C. Jefferds, Jr., Region V, speaker; G. W. Beesley, Region VIII, vice-speaker; and R. E. Wiegand, Region VII, secretary. Speaker Jefferds announced the following committees: Nominating committee personnel, G. W. Beesley, R. G. Tessmer, Sr., E. S. Rowell. The Resolutions Committee consisted of A. C. Ormond, C. E. Crede, and R. W. Mills. The following officers for the 1954 RDC meeting were elected

in accordance with recommendations of the Nominating Committee: John W. Little, speaker; R. W. Worley, vice-speaker; C. W. Crawford, secretary; and J. C. Jefferds, Jr., Agenda Committee.

Resolutions of thanks and appreciation, unanimously approved, were prepared by the Resolutions Committee and signed by A. C. Ormond, C. E. Crede, and R. W. Mills.

1953 ASME Semi-Annual Business Meeting

THE Semi-Annual Business Meeting of The American Society of Mechanical Engineers was held on June 29, 1953, in the Pacific Ballroom of the Statler Hotel, Los Angeles, Calif., in conjunction with the 1953 Semi-Annual Meeting.

President Blackall opened the meeting with an announcement that the 1954 Semi-Annual Meeting had been scheduled for June 20–24, 1954, at the William Penn Hotel, Pittsburgh, Pa. President Blackall then read the names of the nominees for the 1954 National Nominating Committee, who were unanimously elected.

The main order of business was the presenting of several amendments to the Constitution concerning ASME membership requirements.

Purpose of the amendments, it was explained, is to bring ASME membership grade, names, and requirements in accord with the recommendations of the Engineers' Council for Professional Development aimed at insuring greater uniformity in grade names and requirements among the major engineering societies. After the amendments were explained and a brief discussion, it was voted to submit the changes to the membership for letter-ballot vote.

Principal changes proposed would stiffen requirements for membership. The new requirements to be voted on are as follows: A man to be eligible shall be a graduate of an engineering curriculum approved by the Council, and shall in addition have not less than six years' active practice in the profession in engineering or teaching, five of which shall have been in a position of responsible charge. Or if not a graduate, he shall have equivalent attainments, including not less than 12 years' active practice in the profession or teaching, five of which shall have been in a position of responsible charge. A license to practice Professional Engineering, issued by a recognized body, would be considered equivalent to three years of active practice.

Under the present provisions a man is eligible who shall have had eight years of active practice, three years of which are in a position of responsible charge. Graduation from an engineering school is considered equivalent to four years of active practice.

Another amendment to be submitted to the membership provides that the present Junior Member be designated as Associate Member. The present Associate, which is a nonvoting grade, would then be designated "Affiliate." For the Associate Member, a distinction would be drawn between the graduate and nongraduate. If he is a graduate, that fact would be sufficient. If not, he should have at least eight years of engineering experience of a character satisfactory to the Council.

ASME 1954 Nominating Committee Organizes

SELECTED at the 1953 Semi-Annual Business Meeting of The American Society of Mechanical Engineers, Los Angeles, Calif., June 28–July 2, 1953, the 1954 National Nominating Committee at its organization meeting chose Karl P. Hanson, North Carolina State College, Raleigh, N. C., as chairman; and Rolland S. Stover, R. S. Stover Company, 212 Kresge Building, Marshalltown, Iowa, as secretary.

Plans were made for a preliminary meeting of the committee at the 1953 Annual Meeting, New York, N. Y., at which arrangements will be made as to time and location of the executive meeting for nomination of the Society Officers in 1954.

The 1954 National Nominating Committee is composed of the following:

Region I. A. C. Crownfield, Jr., Hart Manufacturing Company, 110 Bartholomew Ave., Hartford 1, Conn.; L. E. Seeley, *1st Alternate*, College of Technology, University of New Hampshire, Durham, N. H.; Theodore N. Graser, *2nd Alternate*, Cochrane Steam Specialty Company, 80 Federal St., Boston 10, Mass.

Region II. Frank L. Bradley, Forstmann Woolen Company, 2 Barbour Ave., Passaic, N. J.; Philip C. Osterman, *1st Alternate*, American Gas Furnace Company, Spring and Lafayette Sts., Elizabeth, N. J.; William S. Johnston, *2nd Alternate*, Sanderson & Porter, 52 William St., New York 5, N. Y.

Region III. Samuel B. Sexton, 3rd, Safe Harbor Water Power Corporation, Lexington Building, Baltimore 3, Md.; Guerard Mackey, *1st Alternate*, Engineering Department, E. I. du Pont de Nemours & Company, Inc., Wilmington, Del.; Charles R. Otto, *2nd Alternate*, Engineering Department, E. I. du Pont de Nemours & Company, Inc.; Room 12430 Nemours Bldg., Wilmington, Del.

Region IV. Karl P. Hanson, *chairman*, Mechanical-Engineering Department, North Carolina State College, Raleigh, N. C.; Neil H. Brown, *1st Alternate*, Manufacturers' Representative, 1907 Liberty Life Bldg., Charlotte 2, N. C.; Roy C. Robertson, *2nd Alternate*, Mechanical-Engineering Department, University of Tennessee, Knoxville 16, Tenn.

Region V. Ernst W. Allardt, Tubular Products Division, The Babcock & Wilcox Company, 640 E. Keystone St., Alliance, Ohio; Henry N. Muller, Jr., *1st Alternate*, Westinghouse Electric Corporation, 401 Liberty Ave., Pittsburgh 30, Pa.; John F. Cunningham, Jr., *2nd Alternate*, Midwest Equipment Company, 545 W. Broad St., Columbus 8, Ohio

Region VI. Rolland S. Stover, *secretary*, R. S. Stover Company, 212 Kresge Building, Marshalltown, Iowa; Frederick V. Hartman, *1st Alternate*, Technical Department, Aluminum Ore Division, Aluminum Company of America, 3300 Missouri Ave., East St. Louis, Ill.; James G. Van Vleet, *2nd Alternate*, Milwaukee Extension, University of Wisconsin, 623 W. State St., Milwaukee 3, Wis.

Region VII. Sigurd T. Johnson, American Smelting & Refining Company, Garfield, Utah; Bertram G. Dick, *1st Alternate*, Department of the Interior, Bonneville Power Administration, 1300 N. E. Union Ave., Portland, Ore.; Harold A. Johnson, *2nd Alternate*, Mechanical-Engineering Department, University of California, Berkeley 4, Calif.

Region VIII. Carl A. Stevens, 1932 North Boston Ave., Tulsa 6, Okla.; Richard B. Stewart, *1st Alternate*, Mechanical-Engineering Department, University of Colorado, Boulder, Colo.; H. B. Atherton, *2nd Alternate*, Kansas City Power & Light Company, Postal Station "F," Kansas City 1, Mo.

Leading Scientist Attend ASME Applied Mechanics Sessions at University of Minnesota

THE University of Minnesota, Minnesota Section of ASME, and industries of the Minneapolis and St. Paul metropolitan area were hosts to the Eighteenth National Applied Mechanics Division Conference of The American Society of Mechanical Engineers at the University of Minnesota, Minneapolis, on June 18–20, 1953. More than 212 of the nation's top research engineers and scientists participated in a symposium on "Digital and Analog Computers and Computing Methods," an outstanding feature of this meeting. Papers were presented by outstanding specialists in the field of applied mechanics and computing systems. Dana Young, professor of applied mechanics in mechanical engineering, was national chairman of this group, and Emory N. Kemler, professor of mechanical engineering, also at the University of Minnesota, was general chairman of the Conference Committees for the Minnesota Section of ASME.

The Applied Mechanics Division Conference is held annually in the United States and the growth of industries in the Minneapolis-St. Paul area that are interested in the development, construction, and use of applied mechanics and computing systems has justified holding the conference here. Among the local companies that are vitally interested in applied mechanics and computing systems for future development are the Mechanical Division of General Mills, Inc.; the Aeronautical Division and the Research Section of the Minneapolis-Honeywell Company; the tape recording and other research divisions of the Minnesota Mining and Manufacturing Company; the processes developed by Engineering Research Associates, now a part of the Reming-

ton-Rand Corp.; research projects of the Minneapolis-Moline Power Implement Company; and many other manufacturing and research companies who are at the forefront of industrial interests in these activities.

The list of nationally known chairmen and authors of papers delivered at the Conference was virtually a Who's Who of scientists and engineers in the mechanics and computing fields. Leading scientists from the Bureau of Standards, research centers, and various universities took part in this event, which authorities deemed to be very successful.

Mina S. Rees, who is the director of the mathematical sciences division of the Office of Naval Research, Department of the Navy, Washington, D. C., was the honored guest at the Conference Banquet, Friday, June 19, at Coffman Memorial Union at the University of Minnesota. Dr. Rees gave the principal address, "Future Field of Application of High-Speed Computers."

The technical program consisting of more than 30 papers was presented at eight sessions. Digests of nine of the technical papers are printed in the ASME Technical Digest section of this issue of MECHANICAL ENGINEERING. Forthcoming issues will carry digests of remaining preprinted papers. Inspection trips to the St. Anthony Falls Hydraulic Laboratory, Rosemount Aeronautical Research Center, and to industrial plants in the Twin Cities area were arranged.

An enjoyable get-together dinner and social hour was held at the Hotel Nicollet, which was attended by more than 100 guests.

Important Need in Engineering Education Discussed at 61st ASEE Meeting

WELL over 2000 educators, engineers, and industrialists interested in engineering education participated in the 61st annual meeting of the American Society for Engineering Education held at the University of Florida, Gainesville, June 22–26, 1953.

In his presidential address before a large assemblage W. R. Woolrich, dean, college of engineering, University of Texas, keynoting the initial session, warned that all industries must use engineering talent more efficiently than they do now to make the best use of America's scarcest resource—present and future engineers. He cautioned that there are some forces influencing the engineering profession which need careful watching. One of these is the attempt of some unions to place the average engineer in a class with tradesmen, particularly with respect to collective bargaining. On the other hand, some areas of industry have been unrealistic in adjustment of salaries, with the result that today salaries for beginning engineers have risen at a much faster rate than have those for qualified engineers with five, ten, or 20 years of service. He emphasized that it is essential that the salaries of accomplished and experienced engineers serve as an incentive for men entering the profession.

Turning to education and the current study of the Committee on Evaluation of Engineering Education, Dean Woolrich urged that the life stream of the profession should flow wider, not deeper, thus putting to an end the pattern of incessant splitting off and subdividing into new engineering degrees.

Leadership in Engineering

In an address entitled "Dependence of Engineering Leadership on Mechanics and Physics," L. E. Grinter, Mem. ASME, dean of graduate school, University of Florida, incoming president of ASEE, asserted that much specialization in the undergraduate curriculum now exists in order to justify the use of the professional-engineering designations of civil, mechanical, and electrical engineer. He contended that these specializations have less significance today than a generation ago and that emphasis should be upon education in the field of engineering science, including increased stress upon the study of mathematics, physics, and chemistry.

C. J. Freund, Mem. ASME, dean of the college of engineering, University of Detroit, gave a preliminary report of the Committee on Ethics. A survey conducted by that group showed that ethical and moral standards remain high among engineers, but that colleges should develop a more positive program for teaching students in terms of ethics. The important matter is that faculties take this responsibility seriously and, working toward it, institute reliable checks to make certain that the responsibility is fully executed.

Technical Institutes

A need for broader objectives in the program of technical institutes to prepare students for life as well as earning a living was stressed by Edwin S. Burdell, president of The Cooper Union, at the annual dinner of the ASEE Technical Institute Division.

"Motivation for participation in a democratic society is just as much an obligation of educators as training to perform well on the job," Dr. Burdell said.

"We simply can't take it for granted that young citizens today will be able to find their way around in human relations in the shop, community, or home," he continued. "They must be helped to make intelligent choice of candidates for office and to become familiar with the modern concepts of family life.

"Young people must be given a foundation for accepting or rejecting proposals for community improvements, especially on school matters, and they must learn to discriminate between good and bad leaders in their unions.

"Above all, young people must be helped to develop a sustaining interest in the common welfare and in the cultural aspects of community life for there are no class distinctions in the ability to enjoy the 'good life.'"

Dr. Burdell said that the growth of technical institutes had been the greatest single innovation in American education in the second quarter of the twentieth century, and compared their growth with the increase in high-school education during the first quarter of the century.

He pointed out that more use of automatic machinery by industry was creating a demand for more technical operating personnel and said that public-school systems should be encouraged to increase and expand the number of technical institutes to alleviate the present engineering-manpower shortage.

Research Activity

In a panel discussion on the encouragement of fundamental research, Joseph W. Barker, Mem. ASME, president, Research Corporation, found a danger in too much dependence on the part of engineering schools upon Federal support. He said under the government's pressure for placing larger amounts of research work, Federal support has become too large a proportion of many schools' total budgets. Mr. Barker added that "to continue to accept classified government-contract research beyond the 'public service in emergency' conditions as a means of carrying institutional overhead would be just as bad as accepting outright government subvention of education."

Good research activity in engineering colleges breaks through the ivory-tower isolation of the purely academic work, according to Harold L. Hazen, dean of the graduate school, Massachusetts Institute of Technology. Further he told that research makes the faculty members actual participants in the professional-engineering world. "This brings to the faculty, and thus to the students, the spirit of fresh thinking on new problems and the courage to venture into new and unfamiliar areas," he said.

Nuclear Engineering Education

In discussing education for participants in an expanding nuclear industry, James W. Parker, past-president and Hon. Mem. ASME, of the Detroit Edison Company, expressed the opinion that engineers making contributions in this field will employ the same underlying principles upon which engineering practice has depended in the past. His undergraduate training should be the same as for other fields, except that there should be more advanced work in mathematics. Mr. Parker added that the solid core of undergraduate studies should continue to be courses in engineering mechanics, thermodynamics, heat transfer, materials of engineering, and the design of structures and machines. Some place should be made for introductory courses in the application of theoretical physics in the production of nuclear energy and dealing also with nuclear-engineering measurement and instrumentation. Extensive training in nuclear theory should be postponed to graduate study following some experience in engineering practice.

A. J. Garcia of the Goodyear Rubber Company made a plea for engineering "generalists" as well as specialists to enter the nuclear-energy field. He added that there is a need for a creative, constructive, synthetic approach to nuclear problems rather than a narrow, analytic approach. The student must have the capacity to deal with the new and unfamiliar with confidence. The growing nuclear industry needs engineers who are educated as whole men and well grounded in fundamentals. Industry is capable of supplying the specialized training.

Research in Heat Power

According to R. G. Folsom, Mem. ASME, professor, mechanical-engineering division, University of California, Berkeley, the over-all objective of research in the university is for the education of staff and student as well as to contribute to the sum total of knowledge. Applied research and development in heat engines is devoted to basic operations, combined operations, and performance of machines and plants. Basic operations in combustion may be considered as fluid flow, heat transfer, and reaction kinetics. On the other hand, combustion may be considered as a basic operation to steam production which is a combined operation. Professor Folsom stated that it is necessary to give more consideration to statistical planning in experimental work in order to avoid spending excessive sums on tests involving unrelated variables. Typical mechanical-engineering theses at the University of California include studies of turbulence in liquid pipe flow, local boiling in vertical tubes, a water-channel analogy to a problem in gaseous combustion, mass transfer in a rising bubble, and the effect of packing density in a crossflow cooling tower.

Honors

Harry S. Rogers, Mem. ASME, president, Brooklyn Polytechnic Institute, received the Lamme Award as the year's distinguished engineering educator and contributor to engineering research.

Edward F. Obert, Mem. ASME, professor of mechanical engineering, Northwestern University, received the George Westinghouse Award, established by the Westinghouse Educational Foundation for annual recognition of young engineering teachers of outstanding ability. Professor Obert is well known in the heat-power field for his texts on thermodynamics.

The society's first two honorary memberships were bestowed on A. A. Potter, Hon. Mem. ASME, dean emeritus, Purdue University, and H. P. Hammond, Mem. ASME, dean emeritus, The Pennsylvania State College. Both men are past-presidents of ASEE and former recipients of the Lamme Award.

E. L. Harrisberger, Jun. ASME, of the University of Utah, and R. J. Smith of California State College, were winners of the ASEE young engineering teacher's paper contest. C. W. Beese, Mem. ASME, Purdue University, was given the James H. McGraw Award for his contribution to technical institute education. C. L. Svenson, Mem. ASME, executive secretary, Texas Board of Registration for Professional Engineers, received the engineering drawing division award.

8th Pan-American Railway Congress Marks Hemispheric Solidarity

Technical Sessions and Track Exhibit Well Attended

THE Pan-American Railway Congress, which began the sessions of its eighth Congress in Washington, D. C., on June 12, moved on June 21 to Convention Hall, Atlantic City, N. J., to meet simultaneously with the member roads of the Association of American Railroads, three divisions of the association, the American Shortline Railroad Association, and the Railway Supply Manufacturers' Association.

More than 6000 railroad officials, engineers, and transportation specialists, including several hundred delegates to the Pan-American Congress, attended business sessions and technical meetings of the railroad industry's leading associations held concurrently with the $20-million exhibit of RSMA, from June 22 to 26.

The Pan-American Railway Congress Association is an autonomous international organization with membership including all American republics. The primary purpose of the association is the improvement of railroad facilities and services in the Western Hemisphere. Among its allied objectives are the reduction of frontier barriers to the movement of rail traffic, the standardization of equipment among nations, the interchange of technical information, and the co-ordination of international rail transportation.

In an address before representatives of several hundred railroads operating in territory from Canada to Argentina, William T. Faricy, President, AAR, said that the investment of more than $8 billion in plant and equipment by the nation's railroads since the end of World War II had produced a "revolution in motive power" by placing in service nearly 18,000 diesel-electric locomotives.

Among other postwar improvements, he listed: more than 500,000 new freight cars, new and diversified types of passenger and freight cars, 12-million tons of new steel rail, 300-million new crossties laid in tracks, advances in signaling and communications by both wire and wireless, and gains in service made possible by the skillful combined use of these varied improvements.

Track Exhibit

This year, as in 1947 when the last railroad convention was held, one of the most interesting spots in connection with the meetings was the 4200-ft track exhibit. Here on four tracks within a single enclosure was shown a modern train, 26 freight cars, four passenger cars, nine diesel-electric locomotives, and a diesel rail car.

The train on exhibition was of the ACF-Talgo design in the exhibit of the American Car and Foundry Company. Other car builders whose products were among the track exhibits included Budd, General American, International Car, Magor, Pressed Steel, and Pullman-Standard. The locomotive exhibits were the showings of American Locomotive—General Electric, Baldwin-Lima-Hamilton, Trainmaster of Fairbanks-Morse, General Motors, and Westinghouse Electric. In addition to the complete units of equipment, there were a large number of car and locomotive specialties included among the track exhibits.

Heavy Fuel for Diesel Economy

The railroads are in an enviable position to seek and develop the use of heavy or low-grade diesel fuels in their operations because of their vast diesel-engine program, pointed out C. G. A. Rosen, Fellow ASME, Caterpillar Tractor Company consulting engineer, who spoke before the Purchases and Stores Division of the AAR June 23.

Mr. Rosen, a pioneer in the development of diesel engines and fuels in this country, explained that in the over-all picture the uses of these cheaper lower-grade fuels have many advantages.

"Why use a heavy fuel in a Diesel engine?" he asked. Then answered by giving three main purposes: To reduce fuel costs, to stretch supplies, and for emergency reasons. "These are all factors which promote a present desire toward finding ways and means of burning fuels which achieve operation at a lower over-all cost," he added.

As a case in point, he said, "A reduction of only one cent per gallon would mean savings of $1,200,000 a year to one railroad."

The reasons for the low cost and availability of the heavy fuels gets back to the present refining methods, he said. A present-day refinery yields approximately 64 per cent in combined gas-gasoline and distillate fuels, 32 per cent in residual fuel, and about 4 per cent is lost in operation out of a barrel of crude oil, Mr. Rosen explained.

"This economic balance in a barrel of crude comes about because of the low price of residual fuel which may possibly remain for a period of time. Many of the refiners do not have sufficient cracking equipment to handle the heavy-gas-oil from residual fuel and there is a large quantity of foreign residual which would come into the market in case of a slight price rise. There is, therefore, some incentive for a heavy gas-oil to be made which would be priced between a No. 2 diesel fuel and a No. 4," Mr. Rosen added.

"Some of the railroads have made progress in utilizing fuels of this category in actual service tests," he continued. "They are proving of sufficient significance that their continuation can be expected. The railroads are in an enviable position to seek such products because of the large quantities involved in railroad use—over 50 per cent of the diesel fuel burned today. The distribution problem would be far less complicated on a railroad than would be the case in isolated vehicle operation."

Mr. Rosen pointed out that the British have extended experience in the successful burning of residual and Bunker C type fuels in European-type diesel engines. One company has been doing this for 25 years, he added. Many European marine diesel-engine manufacturers have similar experiences in the wide scale of adaptability of diesel engines to consume heavy residual types of fuels. "It is admitted that such experiences are at the opposite pole to those on No. 2 diesel fuels; how-

ever, intermediate types of fuel represent degrees of difference between these extremes and call for compromise design modifications," Mr. Rosen explained.

The matter of accommodating the engine to the consumption of a specific type of heavy fuel involves five classes of engineering problems, he said. They are handling, cleaning, burning, lubrication, and maintenance.

Mr. Rosen gave the following explanation of these problems:

1 The handling problem involves filter, pumps, settling tanks, and, in many cases, heaters and centrifuges. The heavier the fuel the more complicated the fuel system becomes.

2 The cheaper the fuel the more equipment needed and greater the chore of cleaning.

3 In burning heavy-type fuels the problem of starting, idling, and high output are factors which must be carefully scrutinized and design characteristics fitted to accommodate their proper functioning.

4 Lubrication has achieved a position where it is in excellent status to accommodate the combustion of the heavier types of fuel. The usual high-wear characteristics associated with high sulphur fuels can be combated with the more highly detergent types of lubricating oils with satisfactory economic results.

5 The over-all savings in burning low-grade fuel is revealed in the maintenance picture. Here the evaluation of wear requiring replacement of parts, the accumulation of deposits requiring greater frequency of overhaul, and the incidence of downtime must all be accounted against the savings accruing by the use of lower-cost fuel.

"In some of the slow-speed marine experiences it has been possible in ships having 3000 horsepower engines over a 200-day per year period to save over $21,000 in over-all operating cost per year," Mr. Rosen explained.

"In conclusion," he said, "The petroleum industry can make anything but whatever they make will be at a price related to finished products as well as to the influence of supply and demand. The mechanical problems are solvable but may not be practical or desirable in all cases and in all operations, but these must be weighed against the fuel savings accounted for by the lower-cost fuel employed in the combustion chamber."

Honors

The winners of honorary awards and more than $13,000 in cash prizes for submitting the best of 168 papers on railroading to the Eighth Pan-American Railway Congress were announced June 25 at a luncheon that followed the final formal session of the Congress.

The top cash prize of $2000 offered by the Organizing Committee of the Congress for originality of thought and approach in the solution of railroad problems was awarded to Ambrosio D. Lopez-Hidalgo of Cuba. The Santiago Brian Memorial Award of 25,000 Argentine pesos went to T. T. Blickle of Los Angeles, Calif., mechanical superintendent, Coast lines, of the Atchison, Topeka and Santa Fe Railway.

Winners of the $1000 prizes included the following: The Eric V. Hauser Memorial Award to Carlos V. Murphy of Lima, Peru. The United States Steel Company prize to C. J. Code of Philadelphia, Pa., The Electro-Motive Division of General Motors prize to Atilio Cappa of Buenos Aires, Argentina, acting president of the Pan-American Railway Congress Association. The National Malleable & Steel Casting Company prize to H. W. Faus, Mem. ASME, consulting engineer, locomotive equipment, the New York Central System. There were several other prizes and honorable-mention awards and certificates of merit which were presented to authors of papers presented to the Congress.

C. G. A. ROSEN ADDRESSES AAR TECHNICAL SESSION

The Prize Award Jury that judged the papers was made up of A. A. Goytisolo of Cuba; L. K. Sillcox, Hon. Mem. ASME; R. G. Montero of Mexico; J. Z. Suarez of Argentina; V. B. Pereira Filho of Brazil; R. R. Gavazzo of Uraguay; M. B. Abad of Mexico; A. Reveron-Larre of Venezuela, and Miss M. D. Quiroga of Argentina, secretary.

The Ninth Pan-American Railway Congress will be held in Buenos Aires in 1956. This Congress, the eighth, was the first to be held in the United States.

Coming Meetings

Hydraulics

A JOINT meeting of the Hydraulics Division of the American Society of Civil Engineers and the International Association for Hydraulic Research will be held in Minneapolis at the University of Minnesota on Sept. 1–4, 1953. Business sessions of IAHR and the Hydraulics Division, ASCE, will be conducted during the convention meeting. The Northwestern Section of ASCE will act as host for the meeting.

Subjects for presentation and discussion at the technical sessions will include: Basic relationships of sediment transportation by flowing water, density currents, air entrainment by flowing water, and waves, beach erosion, and hydromechanics of shore structures.

A bound volume of the proceedings for the technical sessions will be published prior to the meetings and will contain complete copies of all papers accepted for publication.

Additional information concerning the conference may be obtained by writing to Prof. L. A. Johnson, Secretary Convention Committee, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minn.

The North Central regional meeting of the American Geophysical Union will be held immediately before the joint IAHR-ASCE meeting on Aug. 31, 1953. Those interested in attending the AGU meeting are urged to arrive early so that they may attend both meetings.

Industrial Engineering

THE fifth annual industrial-engineering conference will be held on the campus of Michigan State College, Sept. 14–18, 1953. Meetings will be in the Student Union Building.

Six workshop groups are being planned to bring the latest and best of industrial engineering to practicing men in industry. The six groups include: Beginning motion and time study, advanced motion and time study, materials handling and plant layout, production control, quality control, and industrial engineering for small plants.

For a copy of the full conference program write to: Prof. J. M. Apple, Department of Mechanical Engineering, Michigan State College, East Lansing, Mich.

Mechanical Engineering

THE fifth International Mechanical Engineering Congress will be held in Turin, Italy, Oct. 9–15, 1953, during the Salone Internaziona della Tecnica so that participants will be able to visit this important exhibition.

The International Mechanical Engineering Congress this year will be organized by the Associazione Industriali Metallurgici Meccanici Affini on behalf of the Organizing Committee.

The theme for this year's Congress is "Production and Assembly Methods for Components in Mechanical Engineering." This will cover examination and comparison both from the technical point of view and from the standpoint of production costs of the various methods available to industrialists for the design and manufacture of components.

Papers have been submitted for presentation in the following categories: Machining with cutting tools; machining with electricity; finishing; progress in foundry practise; precision casting, drop forging; extrusion, cold forging, and deep drawing; sintering; application of welding; other assembly methods; and comparative studies of the different techniques.

Those desiring further particulars of the Congress and also engineers willing to prepare papers for submission within the scope of the general theme are invited to communicate with The Permanent Secretary, International Mechanical Engineering Congress, 10, Avenue Hoche, Paris VIIIeme, France.

Scholarships

ESTABLISHMENT of a mechanical-engineering scholarship fund at Illinois Institute of Technology, with preference given to candidates living near Rockwell Manufacturing Company plants, was announced by Illinois Institute of Technology.

Under the fund, one or more scholarships will be awarded to a student ready to enter college in September, and additional scholarships will be awarded annually. They will pay full tuition costs for two years with consideration for additional financial aid after the first two years of college studies.

The scholarships will be awarded to candidates fulfilling Illinois Tech entrance requirements. Application will be handled by the personnel director, Edward Valves, Inc., East Chicago, Ind.; or Rockwell Manufacturing Company, 400 N. Lexington Avenue, Pittsburgh 8, Pa.

Hannibal C. Ford Fellowship

AN annual fellowship of $4000, said to be one of the largest of its type anywhere, will bear the name of Hannibal C. Ford, inventor of the first mechanical brain for controlling artillery fire, was announced by President Deane W. Malott of Cornell University. The award will be made each year, starting in 1954, to encourage advanced study for young engineers whose talents mark them as future leaders in science and engineering.

Winners will have complete freedom to study in any branch of electrical or mechanical engineering, engineering physics, or mechanics and materials, according to the Ford Instrument Company, Long Island City, N. Y., donors of the fellowship in the name of its retired founder. The award is open to American citizens in their first year of graduate study, with the hope that the fellowship will give a helping hand to young men with talents and abilities in original scientific work typified by Mr. Ford, inventor, scientist, designer, and electromechanical genius.

Mr. Ford, who was graduated from Cornell 50 years ago, was honored, June 13, 1953, for his inventions which revolutionized modern warfare and helped America turn back aggressors in three wars. Many of his inventions are still top secret. Some that may be mentioned are: The rangekeeper, first mechanical brain for computing naval gunfire; Mark XIX gun director, first device for accurately controlling the fire of antiaircraft guns; first automatic tracking bombsight; system of speed control that makes New York City's subways the world's safest railroad system; over 60 typewriter improvements; and the first automatic computing sight for machine guns.

Engineering Societies Personnel Service, Inc.

These items are from information furnished by the Engineering Societies Personnel Service, Inc., in co-operation with the national societies of Civil, Electrical, Mechanical, and Mining and Metallurgical Engineers. This Service is available to all engineers, members or not, and is operated on a nonprofit basis. In applying for positions advertised by the Service, the applicant agrees, if actually placed in a position through the Service as a result of an advertisement, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient nonprofit personnel service and are available upon request. This also applies to registrant members whose availability notices appear in these columns. Apply by letter, addressed to the key number indicated, and mail to the New York office. When making application for a position include six cents in stamps for forwarding application to the employer and for returning when necessary. A weekly bulletin of engineering positions open is available at a subscription of $3.50 per quarter or $12 per annum for members, $4.50 per quarter for nonmembers, payable in advance.

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Men Available[1]

Mechanical Engineer, RPI, BME, 31, married, 7½ years' total experience in product design and development. Laid out, analyzed, tested, and interpreted research and performance data. Supervised small group of engineers and computors on large projects. Me-985.

Hydraulic Engineer, MSME, 28, married, veteran. Experienced in power-plant engineering. Desires position as hydraulic-testing or development engineer in connection with dam and channel flows, performance characteristics of hydraulic turbines, and other related work in the field of hydroelectric power. Will relocate. Me-986.

Product-Development Engineer, BME, 31, married, veteran, experienced ordnance and civilian-consumer goods, metals and plastics, development, design, model-shop supervisor, pilot runs. Also seven years tool and diemaking. Desires challenging opportunity. Prefers small town. Me-987.

Mechanical Engineer, 54, BSME, 30 years' practical and technical experience in plant engineering and administration, responsible for research and development, design of special tools and machines, broad ideas in the application of modern methods, original ideas which have been tried and proved successful, cost-conscious, interesting background. Available six to eight weeks after agreement reached. Prefers nonmetropolitan New York. Me-988.

Mechanical Engineer, BS, three years operation, maintenance steam, diesel-power plants, three years design, construction, maintenance chemical-process industry. Desires foreign plant engineering position with provision for wife, two children. Me-989.

Mechanical Engineer, 30, MME, PE; six years' experience all phases engineering in process plants, two years materials handling. Desires position in materials-handling field. No extended traveling. New York metropolitan area. Me-990.

[1] All men listed hold some form of ASME membership.

Positions Available

Test Operating Engineer, graduate, at least five years' experience in testing, involving some experience in testing, and some experience with high-speed instrumentation, two years of which should have been in a supervisory capacity. Advanced engineering degrees will be considered as a partial substitute for the experience requirement. Will direct the instrument engineer, supervise data processing, computers, and technical writers in carrying out the following tasks: checks instrumentation against test specifications; checks instruments for operating condition; checks instrument inspection and calibration records; assigns men to testing duties; collects data during the test, arranges same, and directs compiling of data and processing or preliminary test reports. $8000–$9000. Mich. Y-8784-C-1024.

Tool Engineer for plastics division. Should have tooling experience and some knowledge of reinforced plastics. $7000. Va. Y-8785.

Chief Project Engineer and Mill Designer, at least 10 years' experience covering design and layout of aluminum-rolling mills. $12,000–$15,000. New England. Y-8791.

Director of Engineering, Mechanical, 40–45, for heat-processing equipment such as industrial furnaces, drying equipment, and all types of industrial equipment used in manufacturing processes where heating is required. Will be responsible for the design and development of such types of equipment. Must have had some heavy management or administration experience in this field. $15,000 or better. Pa. Y-8793.

Chief Designer, mechanical graduate, 15 years' experience in the design of intricate mechanisms, including minimum of eight years in the administrative direction of a design and drafting group of 30 or more designers and draftsmen, preferably in a contracting organization. Minimum of five years in actual mechanical-design experience at the drawing board. Two years' experience in design or development of munitions desirable. $7200–$10,200. Md. Y-8798.

Senior Industrial Engineer. Must be well experienced in wage incentives, installation, time study, methods, etc. Considerable out-of-town work. $7200–$7800. Headquarters, New York, N. Y. Y-8806.

Engineers. (*a*) Assistant quality control director, 30–40, mechanical or electrical, at least five years' experience supervising quality control engineers, inspection staff, test and service facilities, and shop-training program, covering production of electromechanical devices. $7000–$8000. (*b*) Technical assistant, under 30, quality control experience covering electrical and mechanical components. $4118. Queens, N. Y Y-8815.

Chief Engineer, 40–50, mechanical graduate at least 10 years' experience covering design, production, and application of gear pumps up to 1000-lb pressure. $9000–$10,000 plus bonus. Midwest. Y-8831.

Mechanical Engineer, good background in the organization of machine and boiler shops and the use of heavy machine tools and equipment such as lathes, planers, milling machines, etc., and of welding in general. Will act as staff man for studying boiler and machine-shop organization, supervise the use of the machines and tools, control the processing works, and the quality of production to the best advantage for the machine and boiler-shop operations. ME degree and 10 years' experience necessary, preferably in steel mills or heavy machinery-industry maintenance and repair shops. Two-year contract. Brazil. F-8843.

Chief Engineer, 42–50, mechanical or electrical degree, with background of successful administration of the engineering function from headquarters of a multiplant heavy industry, preferably an integrated primary producer of metal. Will direct the engineering operations of the company, acting in a staff capacity and reporting to the company production head. $20,000–$25,000. Calif. Y-8845.

Sales Engineer, 35–45, mechanical-engineering background, to take over the sales managership of a large machine-tool builder. Should have had some previous experience in the machine-tool field and a good record in sales. Limited travel to six district offices. Excellent opportunity for advancement. Salary plus profit sharing will equal about $15,000 a year. Headquarters, Midwest. Y-8868.

Engineers. (*a*) Product design, development, and research engineer, graduate mechanical, about three to five years' experience, for fan manufacturer. Some experience in sheet metal required. Fan experience desirable, but not a prerequisite. $5720–$5980. (*b*) Engineer, mechanical, recent graduate, one or two years' experience, for quality-control work. Will eventually supervise all quality control. Presently will do some inspection, set tolerances, act as liaison

(*ASME News continued on page 686*)

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between design and production. $4160–$4680. Northern N. J. Y-8869.

Mechanical Engineer-Designer, preferably experience in the design of materials-handling equipment or in some other branch of automotive design. Will consider recent graduate with aptitude for design and a good draftsman. Brooklyn, N. Y. Y-8874.

Product Engineers, juniors to seniors, ME or EE degrees, to handle product for company, through engineering to manufacturing in the field. Company manufactures heavy equipment. $4332–$5388. New York metropolitan area. Y-8879.

Assistant Master Mechanic, mechanical or chemical engineer, about 35. Some experience in equipment design, mostly handling of men engaged in repair and construction. Knowledge of process equipment. Will supervise and direct foremen and mechanics on repair and construction work—about 75 men. Will also supervise steam and power production (7000 kw), for corn-products manufacturer. $7200. Employer will pay expense of trip for interview. Iowa. C-1028.

Toolroom Foreman, up to 40, at least three years' experience in supervisory toolroom work. Knowledge of dies, jigs, and fixtures. Will supervise toolroom and do some tool-design engineering. No deep-draw dies. Company manufactures automotive accessories. $6500–$7280. Employer will pay placement fee. Ill. C-1033.

Chief Product-Development Engineer, 35–55, at least three years' experience in pressed metal-product development. Knowledge of shop operations. Will supervise design and development of new products in lawn-mower field, both power and hand. $7200–$8400, plus bonus. Employer will pay placement fee. Miss. C-1035.

Chief Mechanical Engineer, to 45, mechanical graduate, 10 years' experience in design and development. Knowledge of air, hydraulics, and electricity. Will take charge of engineering department, product development, design, production, and maintenance for manufacturer (employing 80 people) of portable compressors and domestic paint sprayers. $8000–$12,000. Employer will negotiate placement fee. Ill. C-1048.

Project Engineer, BS, ME, or MS, to 40, six or eight years' experience in development of high-speed automatic machinery, kinematic stress, and preferably dynamic analysis. Will initiate long-range research projects, carry technical responsibility, supervise two to eight engineers, write technical reports, maintain liaison. Research and development in automatic machinery, servo techniques, military research. $7800–$10,800. Employer will negotiate placement fee. Ill. C-1060.

Production Superintendent, up to 45, at least five years' experience in supervisory work in metal trades. Will supervise production of 105 wrap around shell. Must be citizen and clear through F.B.I., for a manufacturer of metal products. $8000. Employer will pay placement fee. Ill. C-1075.

Theoretical Applied Mechanics Research Engineer, PhD, up to 45, must be strong on stress analysis and able to pass rigid physical. Will do high-level research work in applied mechanics for a refinery. Up to $12,000. Ill. C-1082.

Candidates for Membership and Transfer in the ASME

THE application of each of the candidates listed below is to be voted on after Aug. 25, 1953, provided no objection thereto is made before that date and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the secretary of The American Society of Mechanical Engineers immediately.

KEY TO ABBREVIATIONS

R = Re-election; Rt = Reinstatement; Rt & T = Reinstatement and Transfer to Member

NEW APPLICATIONS

For Member, Associate, or Junior

ATKINSON, HOWARD R., Maywood, Calif.
BENTLEY, DONALD J., Los Angeles, Calif.
BEVERIDGE, MILTON C., Fairfield, Conn.
BROWN, VERLE H., Salt Lake City, Utah
BRUSH, JAMES P., Merrick, L. I., N. Y.
CAMPBELL, DAVID S., Glen Ellyn, Ill.
CAREY, WILLIAM T., Euclid, Ohio
CARR, HENRY S., JR., Pittsburgh, Pa.
CHIVINGTON, DEANE H., Jacksonville, Fla.
CHRISTIAN, ROBERT F., San Francisco, Calif.
CHRISTOFF, CHRIS A., San Gabriel, Calif.
COOK, MELVIN S., Rockdale, Texas
COOPER, JAMES, Columbus, Ohio
DAVIES, JAMES F., Ridgefield, N. J.
DAY, RICHARD A., Chicago, Ill.
DEAN, ROBERT C., JR., Cambridge, Mass.
DICKHONER, WILLIAM H., Cincinnati, Ohio
DION, LAWRENCE J., Bristol, Conn.
DIONISOS, TAKIS P., Flushing, L. I., N. Y.
DODION, HUGH C., Chicago, Ill.
DUNBAR, ALEXANDER H., Glasgow, Scotland
DYSON, HENRY A., New Britain, Conn.
EIBLING, JAMES A., Columbus, Ohio
FAINSTAT, MICHAEL M., Montreal, P.Q., Can.
FISHER, JOSEPH H., Severna Park, Md.
FRIED, JACOB M., Vicksburg, Miss.
GONZALES, EMITERIO E., Denver, Colo.
HABER, WILLIAM F., Washington, D. C.
HAMPTON, ROBERT K., Garden City, N. Y.
HEBBLER, CHARLES B., Yeadon, Pa.
HEINRICH, NEAL C., Los Alamos, N. Mex.
HOMAN, EUGENE M., Aiken, S. C.
HOWALD, JOHN, Passaic, N. J.
JENSEN, ROBERT J., Cincinnati, Ohio
KHITHA, NAND L., Paharganj, New Delhi, India
KIHNLEY, NORMAN W., Maywood, Calif.
KILLGORE, CECIL L., Lakewood, Colo.
KLEYN, CORNELIUS, Youngstown, Ohio
KOCZAN, STEVEN P., South Bend, Ind.
KUNNEMANN, ELMER A., Houston, Texas
LAFFERTY, CLIFFORD R., Oswego, Ore.
LANG, ROY B., JR., Syracuse, N. Y.
LAWRENCE, RICHARD D., Menlo Park, Calif.
LEHARDY, CLEMENT D., Hartsville, S. C.
LETO DI PRIOLO, CARLO E., Milan, Italy
LEWIS, DONALD E., Clarks Summit, Pa.
LONGSON, JOSEPH, Hornell, N. Y.
LORENS, RICHARD, Philadelphia, Pa.
MARTIN, ANDREW G., Latrobe, Pa.
MATEJKA, ANTHONY E., Canton, Ohio
MATTHEWS, GORDON L., Rochester, N. Y.
MEARS, CARLETON M., JR., Newport Beach, Calif.
METELIZ, IRVING, Bayonne, N. J.
MILLER, ARTHUR P., Hopkins, Minn.
MOMOSE, KIYOHIRO T., New Haven, Conn.
MORGESON, DARRELL W., Los Alamos, N. Mex.
MORRISON, BERTRAM I., Oakland, Calif.
NEUGEBAUER, FRANZ J., Schenectady, N. Y.
PAYNE, ANDREW H., JR., Birmingham, Ala.
PITTAM, WILLIAM, Eugene, Ore.
POILLON, WILLIAM A., Montclair, N. J.
RADLEY, ERNEST, JR., Bloomington, Ill.
RANDMAN, JEROME M., Wilmington, Del.
RANOV, THEODOR, Buffalo, N. Y.
REEKIE, WILLIAM R., Peterborough, N. H.
REESE, WILLARD A., Roselle, N. J.
REMPALSKI, EDWARD A., Los Angeles, Calif.
REYNOLDS, JOHN A., Charleston, W. Va.
RIEDEL, WALTER L., Catonsville, Md.
ROUND, JOHN J., JR., Wakefield, Mass.
RUSSELL, SCOTT H., Hunlock Creek, Pa.
SEELER, HENRY W., Dayton, Ohio
SINHA, NIRMAL C., Calcutta, India
SMITH, SPENCER V., Wayne, Pa.
SQUIRE, JOHN W., Tulsa, Okla.
STEDFELD, ROBERT L., Lakewood, Ohio
STENSTEDT, ERIK, Berkeley, Calif.
STEVENSON, DONALD R., Windsor, Ont., Can.
SWINT, ALBERT G., JR., Cordele, Ga.
TOMS, DALE W., Toledo, Ohio
ULMER, ALBERT R., Philadelphia, Pa.
VILLERS, RAYMOND, New York, N. Y.
VODILLE, MICHAEL J., Buffalo, N. Y.
VOLLERS, GEORGE J., Melrose Park, Ill.
WETMILLER, ROBERT S., Fishkill, N. Y.
WIJESOMA, DEN J., Kankesanturai, Ceylon
WILDMAN, JOHN, Boston, Mass.
WILLIAMS, SAM B., Birmingham, Mich.
WILLIAMS, WAYNE E., New Orleans, La.
WIXOM, RICHARD W., Akron, Ohio
YONTAR, MEHMET, New York, N. Y.
YOUNG, JOHN, JR., Corona, N. Y.
YOUNG, WILLIAM, St. Catherines, Ont., Can.
ZOBER, JOHN J., Aberdeen, Md.

CHANGE IN GRADING

Transfers to Member and Associate

BELL, HAROLD S., JR., Summit, N. J.
BOROWCZYK, JAN S., Hamilton, Ont., Can.
BRINSON, LEO T., JR., Milwaukee, Wis.
BUHLER, CARL, New Haven, Conn.
COLLEY, JOSEPH F., Savannah, Ga.
CRAIG, GORDON D., San Francisco, Calif.
CRAMER, WESLEY G., Cincinnati, Ohio
DAVIES, JAMES A., New York, N. Y.
FINSTER, GEORGE C., West New York, N. J.
GARDNER, WALLACE W., Glen Rock, N. J.
GLOOR, WILBUR T., South Norwalk, Conn.
HENSINGER, CLAUDE E., Palmerton, Pa.
HODGE, PHILIP G., JR., Los Angeles, Calif.
HOLM, RUSSELL H., Birmingham, Ala.
JONES, JAMES R., Chicago, Ill.
KOENIG, ROBERT J., San Diego, Calif.
MARK, MELVIN, Cambridge, Mass.
MAUND, EARL C., San Francisco, Calif.
MERCER, SAMUEL, JR., East Lansing, Mich.
MORRIS, WILLIAM C., Washington, D. C.
NEAL, GORDON W., Waterloo, Iowa
PEYTON, JESSE A., Birmingham, Ala.
POLLAK, JOHN P., Manhassett, N. Y.
RICHARDSON, WILLIAM H., Oklahoma City, Okla.
SANT, JOHN W., New Castle, Pa.
SMITH, ADDISON T., Maplewood, N. J.
SPIESZ, CARLYSLE P., Buffalo, N. Y.
STRAUSS, LEOPOLD, East Rockaway, L. I., N. Y.
VERSAW, WILLIAM D., Lincoln, Neb.
WACKER, EMIL J., JR., Dallas, Texas
WEISSELBERG, ARNOLD, Long Island City, N. Y.
WILLMS, HENRY C., Malvern, Ark.

Transfers from Student Member to Junior 450

Obituaries

Walter Baeckler (1893–1953)

WALTER BAECKLER, works engineer, National Carbon Company, Cleveland, Ohio, died May 10, 1953. Born, Cleveland, Ohio, March 25, 1893. Parents, Charles F. and Louisa (Maahs) Baeckler. Education, BEE, Ohio State University, 1916. He held several U. S. Patents pertaining to means for adjusting variable condensers, irradiators, and irradiating processes and apparatus. Mem. ASME, 1945.

Albert Lundy Baker (1897–1953)

ALBERT L. BAKER, chairman, boards of the Vitro Corp. and the Vitro Manufacturing Co., and active in the development of atomic energy for both wartime and peacetime uses, died May 4, 1953. Born, Englewood, N. J., Dec. 27, 1897. Parents, William M., Jr., and Cordelia M. (Lundy) Baker. Education, BS(EE), University of Washington, 1922. Married Mary E. Pray, 1921. He held several patents on apparatus for firing furnaces (Baker Register) and a temperature measuring device. He was credited with a major role in the engineer designing and building of the gaseous diffusion plants at Oak Ridge, Tenn., for the Manhatten Project. Two such diffusion plants, costing $500 million and used to separate U-235 from U-238, were built in less than two years under Mr. Baker's direction. He was one of five scientists, industrialists, and educators who, in April, 1953, formed the Atomic Industrial Forum, Inc., to study and foster ways of developing atomic energy for peacetime uses. Mem. ASME, 1936. He served the Society as vice-chairman, Nuclear Energy Application Committee. Survived by wife; three sons, Albert L., Jr., Ayres D., and Dr. James P. Baker; a daughter Sandra A. C.; and two grandchildren.

William John Callahan (1909–1952)

WILLIAM J. CALLAHAN, production engineer, Consolidated Edison Co. of New York, died Nov. 10, 1952. Born, Fall River, Mass., April 26, 1909. Parents, John and Mary (Riley) Callahan. Education, BS, Rhode Island State College, 1930. Married Mary E. Nortz, 1947. Jun. ASME, 1934; Mem. ASME, 1942. Survived by wife and two children, John F. and Marjorie A.

Henry Rice Cobleigh (1880–1953)

HENRY R. COBLEIGH, a former secretary of service for the National Automobile Chamber of Commerce, now known as the Automobile Manufacturers Association, who had also been active in trade publications, died May 29, 1953. At the time of his death he was employed by the Society as a technical editor. He was at different times employed by *Power* as managing editor; by *Iron Age;* and the Chilton Publishing Co. Born, Cleveland, Ohio, March 7, 1880. Education, BS(ME), Cornell University, 1901. He was co-author of "Mathematics for the Practical Engineer"; from 1928 to 1940, contributed to "International Year Book," Automobile Review of the Year; contributed to "Encyclopedia Americana," vol. 15, International Combustion Engines. Mem. ASME, 1946. Survived by wife, Mrs. Florence Stevens Cobleigh; a daughter, Mrs. Gordon F. McMahon; a son, Nelson S.; and a sister, Nellie S. Cobleigh.

George Emory Doke (1877–1951)

GEORGE E. DOKE, retired president, The Association of Manufacturers of Chilled Car Wheels, Chicago, Ill., died at his home in Yonkers, N. Y., Dec. 6, 1951, according to a report recently received by the Society. Born, Tecumseh, Mich., Aug. 19, 1877. Parents, Emory A. and

(*ASME News continued on page 688*)

Sady (Medlock) Doke. Education, high-school graduate; ME, ICS, 1904. Married Anna M. Brumbaugh, 1903. Assoc-Mem. ASME, 1919; Mem. ASME, 1921. Survived by wife and three children, Jack E., Buffalo, N. Y.; Ernest G., Mem. ASME, Winnetka, Ill.; Marjorie Ann; and eight grandchildren.

Benjamin Hugh Edgar Fletcher (1921–1952)

BENJAMIN H. E. FLETCHER, production engineer, Fletcher Manufacturing Co., Toronto, Ont., Can., died Aug. 17, 1952. Born, Toronto, Ont., Aug. 25, 1921. Education, BS(ME), University of Toronto, 1949. Jun. ASME, 1951.

John Winfield Gilmore (1873–1953)

JOHN W. GILMORE, research engineer, Boiler Division, Fidelity & Casualty Co. of New York, died April 14, 1953. Born, Jersey City, N. J., May 25, 1873. Parents, Winfield F. and Emma (Jay) Gilmore. Education, ME, Stevens Institute of Technology, 1894. Married Helen Hitchcock, 1896. He served in the Spanish-American War as an ensign in the Navy; in World War I, ordnance captain, Army. Mem. ASME, 1927. Survived by wife and six children, Mrs. H. G. McElroy, Winfield S., William H., John F., Mrs. Madeleine Provenzano, Maj. Charles H. Gilmore, Korea; and six grandchildren.

William Dale Henry (1924–1953)

WILLIAM D. HENRY, test engineer, Excello Corp., Detroit, Mich., died in 1953, according to a recent report received by the Society. Born, Detroit, Mich., July 28, 1924. Education, BS(ME), University of Michigan, 1950. Jun. ASME, 1950.

Ward Edwin Miller (1916–1953)

WARD E. MILLER, special engineer to assistant works manager, Cast Armor Division, American Steel Foundries, East Chicago, Ind., died May 15, 1953. Born, Detroit, Mich., June 30, 1916. Parents, Ward E. and Lulu G. (Richardson) Miller. Education, BSME, Michigan State College, 1937. Married Morine Renfrow, 1949. Mem. ASME, 1953. Survived by wife; children, Carol and Betty, Hammond, Ind.; Dennis and Patrick, Sloatsburg, N. Y.; his mother, three sisters, and a brother.

Magnus Mowat (1875–1953)

MAGNUS MOWAT, Brigadier General, C.B.E. (Mil.), T.D. (Regular Army, Reserve of Officers), secretary emeritus of The Institution of Mechanical Engineers, London, England, died Jan. 19, 1953. Born, Bombay, India, Nov. 10, 1875. Education, Aberdeen Grammar School, 1881–1883; Blackheath Proprietory School, 1883–1891; King's College, London, 1892–1895; Associate of King's College, 1895; Fellow of King's College, 1929. Mem. ASME, 1938; Fellow ASME, 1938. During World War I, General Mowat, who was a Territorial officer, served in the Royal Engineers; for two years in command of a division of the Royal Engineers and afterward in a number of staff appointments, as Commandant of the School of Heavy Bridging and Pontooning, and as Command Roads Officer at the War Office, where, at the close of the war, he was deputy chairman and administrative officer of the Joint Roads Committee. For these services he received the C.B.E. in 1919, and the honorary rank of Brigadier-General. In 1920 he was appointed to the secretaryship of the Institution, which he held for 18 years; ill-health obliged him to relinquish it. He was a member of the Institution of Civil Engineers and the Institution of Engineers and Shipbuilders in Scotland; a Fellow of the Royal Society of Edinburgh and of the Chartered Institute of Secretaries. In the City of London, he was a liveryman of the Worshipful Company of Clockmakers.

Herbert Oswald Sauer (1887–1953)

HERBERT O. SAUER, design engineer, Delta-Star Electric Division, H. K. Porter Co., Inc., Chicago, Ill., died April 27, 1953. Born, Pulsnitz, Saxony, Germany, Dec. 15, 1887. Education, Zeidler's Oberrealschüle, Dresden, Germany, 1905; CE, Technische Hochschüle, Dresden, 1908; ME, Technische Staatslehranstalten, Chemnitz, Germany, 1912. Naturalized U. S. citizen, Baltimore, Md., Dec. 13, 1919. Mem. ASME, 1950. Survived by wife, Alma Elizabeth Sauer, and two sisters.

Edward Schildhauer (1872–1953)

EDWARD SCHILDHAUER, supervising electrical and mechanical engineer during the construction of the Panama Canal, from 1906 to 1914, died May 24, 1953, in Los Angeles, Calif. Born, New Holstein, Wis., Aug. 21, 1872. Parents, J. and Dorothea S. (Kuehl) Schildhauer. Education, BS(EE), University of Wisconsin, 1897; EE, 1911. Married Ruth Barton Crall, 1902. While serving on the canal project, he designed and patented the lock operating machinery and the system of electric locomotives for towing ships through the locks. Mem. ASME, 1911. Author of several technical articles published in professional journals. Survived by wife and three sisters, Mrs. Anna Francke, Claire Schildhauer, Ellen Schildhauer, of New Holstein, Wis.

William Randolph Teller (1904–1953)

WILLIAM R. TELLER, vice-president and director of research and engineering, Bryant Heater Corp., Cleveland, Ohio, died May 2, 1953. Born, Bowling Green, Ohio, June 14, 1904. Education, BS(ME), Case Institute of Technology, 1927. Mem. ASME, 1947. Survived by wife, a son, and a daughter.

William Milton Whitney (1863–1953)

WILLIAM M. WHITNEY, president, Baxter D. Whitney & Son, Inc., Winchendon, Mass., died May 2, 1953. Born, Winchendon, Mass., March 27, 1863. Parents, Baxter D. and Sarah J. (Whitney) Whitney. Education, BS(ME), Massachusetts Institute of Technology, 1884. Married Ada Macleod, 1893 (died 1926). Married 2nd, Ethel Deering Stockman, 1927 (died 1931). Married 3rd, Marion Burns Cutter, 1931. Assoc. ASME, 1886. In 1952 he received a 65-year ASME membership certificate. Survived by wife; two daughters, Charlotte, Winchendon, Mass.; Mrs. Pauline Lord, Peterborough, N. H.

Perley Smith Wilcox (1874–1953)

PERLEY S. WILCOX, chairman, Tennessee Eastman Co. and the Texas Eastman Co., and until 1952 chairman of the board, Eastman Kodak Co., died May 17, 1953. Born, Mexico, N. Y., June 18, 1874. Parents, Luzern H. and Mary E. (Smith) Wilcox. Education, ME, Cornell University, 1897. Married Isabelle V. Blake, 1904. Jun. ASME, 1899; Mem. ASME, 1914. Survived by wife.

Keep Your ASME Records Up to Date

ASME Secretary's office in New York depends on a master membership file to maintain contact with individual members. This file is referred to dozens of times every day as a source of information important to the Society and to the members involved. All other Society records and files are kept up to date by incorporating in them changes made in the master file.

From the master file are made the lists of members registered in the Professional Divisions. Many Divisions issue newsletters, notices of meetings, and other materials of specific interest to persons registered in these Divisions. If you wish to receive such information you should be registered in the Divisions (no more than three) in which you are interested. Your membership card bears key letters opposite your address which indicate the Divisions in which you are registered. Consult reverse side of card for the meaning of the letters. If you wish to change the Divisions in which you are registered, please notify the Secretary's office.

It is important to you and to the Society to be sure that your latest mailing address, business connection, and Professional Divisions enrollment are correct. Please check whether you wish mail sent to home or office address.

For your convenience a form for reporting your address, business connection, and Professional Divisions enrollment is printed on this page. Please use it to keep the master file up to date.

Four weeks are required to complete master-file changes.

ASME Master-File Information

(Not for use of student members)

Please print — **Check mailing address**

Name ..... (Last — First — Middle)

Home address ..... (Street — City — Zone — State) ☐

Name of employer .....

Address of employer ..... (Street — City — Zone — State) ☐

Product or service of company .....

Title of position held .....

Nature of work done .....

Please register me in three Professional Divisions as follows:

1 .....

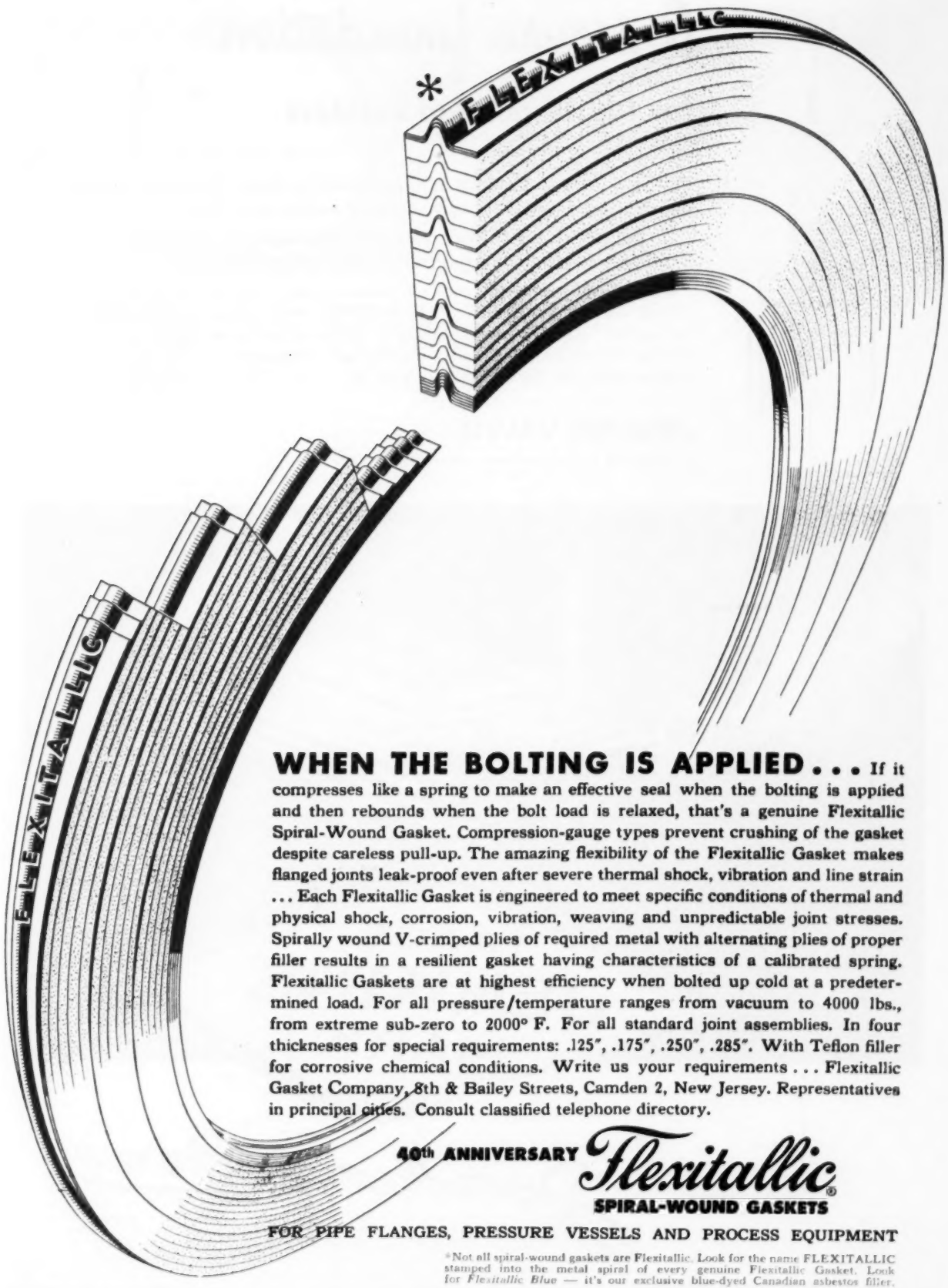
2 .....

3 .....

(Processing of address change requires four weeks)

I am a subscriber to (please check)

Transactions ☐ Journal of Applied Mechanics ☐ Applied Mechanics Reviews ☐



WHEN THE BOLTING IS APPLIED . . . If it compresses like a spring to make an effective seal when the bolting is applied and then rebounds when the bolt load is relaxed, that's a genuine Flexitallic Spiral-Wound Gasket. Compression-gauge types prevent crushing of the gasket despite careless pull-up. The amazing flexibility of the Flexitallic Gasket makes flanged joints leak-proof even after severe thermal shock, vibration and line strain . . . Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally wound V-crimped plies of required metal with alternating plies of proper filler results in a resilient gasket having characteristics of a calibrated spring. Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 4000 lbs., from extreme sub-zero to 2000° F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". With Teflon filler for corrosive chemical conditions. Write us your requirements . . . Flexitallic Gasket Company, 8th & Bailey Streets, Camden 2, New Jersey. Representatives in principal cities. Consult classified telephone directory.

40th ANNIVERSARY *Flexitallic*®

SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Not all spiral-wound gaskets are Flexitallic. Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket. Look for *Flexitallic Blue* — it's our exclusive blue-dyed Canadian asbestos filler.

KEEP INFORMED

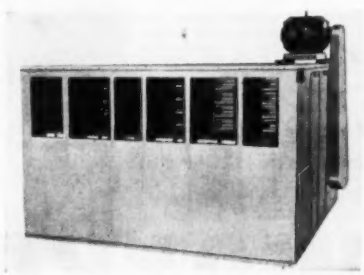
NEW EQUIPMENT | BUSINESS NOTES | LATEST CATALOGS

Available literature or information may be secured by writing direct to the manufacturer. Please mention MECHANICAL ENGINEERING.

NEW EQUIPMENT

Marlo Installs 18 Multi-Zone Units

Protecting delicate equipment and maintaining year-round comfort for employees in the new Michigan Bell Telephone Co. annex in Detroit demands air conditioning of versatility and dependability.



Eighteen Marlo Multi-Zone Units, made by the Marlo Coil Co., St. Louis, Mo., each capable of performing six separate air-conditioning functions simultaneously, were chosen to meet the complex and exacting requirements for comfort and protection in the new building. Architects and engineers for the Michigan Bell Annex were Smith-Hinchman & Grylls, Inc. Bryant & Detwiler Co. was general contractor and Harrigan & Reid Co. was mechanical contractor.

Button-Head Socket Screws

The Allen Mfg. Co., Hartford, Conn., originators of the Allen hex socket screw, announces that it is now in full production of button-head socket screws. The purpose of the Allen button-head cap screw is to allow for smoother, more streamlined surfaces, which are desirable in many applications that do not permit countersinking. Their rounded tops and flush edges also prevent exposed sides, thus eliminating the hazard of catching on clothing.

The button-head cap screw is necessarily shallower than the standard socket screw and the socket acquires the needed strength through the Allen process of Pressur-Forming and the use of special Allenoy steel, the manufacturer says. In this Pressur-Forming process, the screw body is cold-worked and the socket head is cold-drawn.

Sizes in these new button head cap screws range from 8 × 1/4 in. through 5/8 × 2 in. standard with NC threads. These sizes are also standard with NF threads, except in 1/2-in. and 5/8-in. diameters.

Laminated Fiber Recharge for Full-Flow Filtering

An expendable, laminated fiber disk recharge, said to have four to ten times the useful life of cellulose, waste, or redwood, has been designed by the William W. Nugent & Co., Inc., for the full-flow filtering of large quantities of oil. It is classed as an extended-area recharge because its actual filtering area is greater than the area of its container.

In a recent test on a 1000-hp supercharged diesel engine at an oil company's pipeline station, the new laminated disk recharges kept the oil cleaner (0.02 per cent by volume) for a period of 3500 engine hours or nearly 12 times as long as the cotton waste recharges ordinarily used.

The laminated disks remove foreign solids smaller than two microns and the absorption of these solids after 48 hr of draining at 70 F is 2 1/2 times the weight of the recharge.

Tube Fittings

The Parker Appliance Co. has added long and extra-long male elbows made in steel as standard stock items to its line of Triple-lok industrial tube fittings. The new fittings will serve all applications of the original line, principally: industrial hydraulic systems, instrumentation; process piping in refineries; power and chemical plants; coolant and lubrication systems for machinery; fuel systems for truck pumps and diesel engines; and marine hydraulic systems.

Although the standard stock of these new fittings will be steel, the two new shapes are available, on special order, in brass, stainless steel (type 316), and aluminum. The fittings as purchased include body nut and sleeve.

Bulletins 4310A10 (long) and 4310A11 (extra long) and additional information on the fittings may be obtained from the Parker Appliance Co., 17325 Euclid Ave., Cleveland, Ohio.

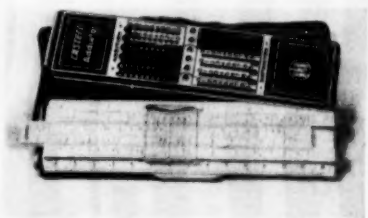
Radio-Controlled Valve

An electronically controlled valve, constructed from special specifications by The Lunkenheimer Co. of Cincinnati, Ohio, for the Continental Supply Co., was used in a joint demonstration with the Radio Corporation of America. Featured during the 30th International Petroleum Exposition at Tulsa, Okla., May 14–23, the electronically controlled 300-lb Lunkenheimer steel gate valve was located in the Radio Corporation of America booth in the Continental Building next to the Lunkenheimer booth, on the Exposition grounds. The electronic controls which operated the valve were set up in the lobby of the Mayo Hotel in downtown Tulsa, and the valve mechanism was activated by microwave radio. Television cameras and receivers at the hotel and at the exposition grounds enabled observers at the hotel to watch the valve operating at the exposition grounds and observers at the exposition grounds to see the operator push the control buttons at the hotel.

The demonstration is believed to be the first in which a valve was electronically controlled at such a distance. Engineers pointed out that electronically controlled valves can be operated from a central location by remote control, thus increasing efficiency an reducing time. Valves operated by remote control also can be installed in locations not readily accessible.

Slide Rule and Adding Machine

Mechanical engineers, designers and mathematicians are expected to find the Castell Addiator Slide Rule useful for many types of calculations including addition and subtraction. Available in three different styles and two lengths (5 in. and 10 in.), it has a variety of useful scales to speed computations.

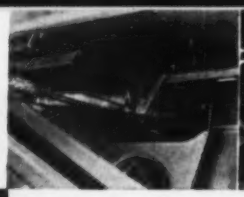


The No. 67/54R System Darmstadt style, which is especially useful for electronic and electrical calculations, has the usual A, B, C, D, and CI scales, as well as a cube scale, common logarithmic scale, a Pythagorean scale $\sqrt{(1-x)^2}$, trigonometric scales, and a log-log scale. In addition, a compact adding machine is attached to the back of the rule. It is operated with a metal stylus that is held at the side of the unit by a clip when not in use. Further information can be obtained from A. W. Faber-Castell Pencil Co., Inc., Dept. ME, Newark 3, N. J.

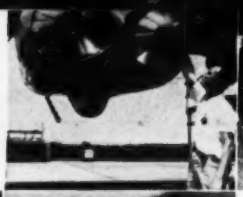
Small Titanium Tubing

The smallest size tubing ever drawn from commercially pure titanium has been announced by Superior Tube Co., Norristown, Pa. Outside diameter is only 0.0455 in.; wall thickness is 0.00225 in. At present, this unusually small size titanium tubing is used for experimental work in electrical, electronic, and chemical industries. Several experimental cathodes have been produced by Superior for the electronics industry, for example.

Superior produces commercially pure titanium tubing in sizes from 1/8-in. to 1 1/2-in. outside diameter, with wall thickness from 0.004 in. to 0.187 in., in both seamless and Weldrawn grades. It is used in chemical processing, pharmaceutical, and aircraft industries. Titanium is one of fifty-five analyses of small-diameter precision tubing produced by Superior Tube Co.



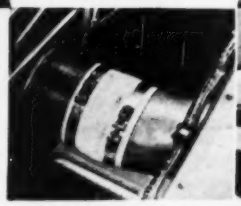
Each of the 12 vents on the B-36 are wrapped with resistance wire and Silastic R. Tape to keep ice from plugging oil vent lines.

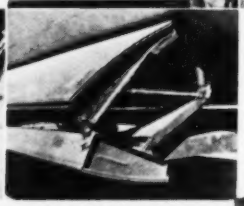


Thin layers of Silastic insulate bare resistance wire inside jet intake door panels; conduct deicing heat evenly and rapidly to panel surfaces.

More than 180 limit switches on the B-36 are protected with Silastic boots to assure reliable operation at temperatures ranging from —100° to 170°F.

Silastic-coated glass cloth gaskets on the rockerboxes of the P & W engines give long service in contact with oil at temperatures up to 450°F.

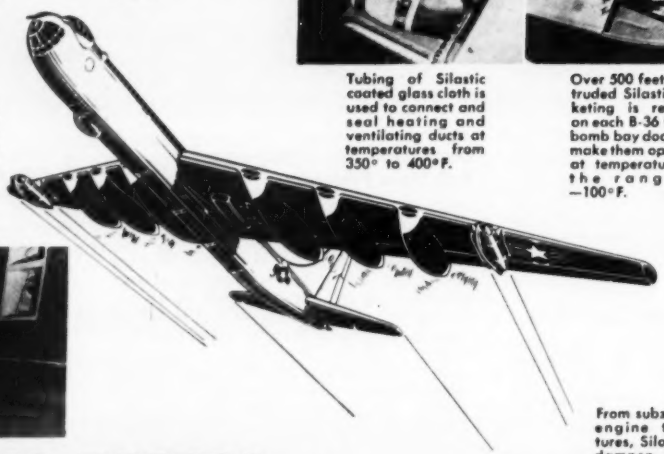




Nose turrets are sealed with two 36-inch lengths of cloth-wrapped, sponged Silastic tubing.

Over 300 Silastic flange gaskets in each B-36 seal hot air system at temperatures as high as 400°F.

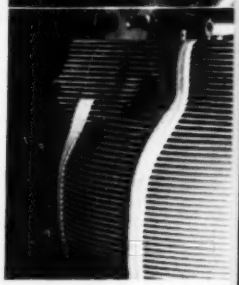
"Orlon" wrapped, sponged Silastic seals prevent air turbulence between flap and engine nacelle; last 10 times as long as materials previously used.



Tubing of Silastic coated glass cloth is used to connect and seal heating and ventilating ducts at temperatures from 350° to 400°F.

Over 500 feet of extruded Silastic gasketing is required on each B-36 to seal bomb bay doors and make them operable at temperatures in the range of —100°F.

Ninety feet of cloth-wrapped, sponged Silastic is used to prevent turbulence and short circuiting of air between leading edge of the flaps and trailing edges of the wings.



From subzero to hot engine temperatures, Silastic strips dampen vibration and prevent breakage of cooling fins on aircraft engine cylinders.

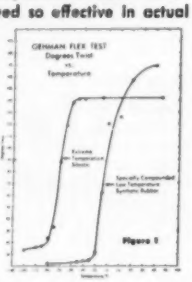
Performance proves...

SILASTIC* works

where other materials fail!

Extreme temperature Silastic stocks are the only rubbery materials that retain their resilience after long exposure to temperatures from —100° to 350°F or after repeated short term exposure to temperatures from —130° to over 500°F. That's why Silastic parts have proved so effective in actual service on the high flying Convair B-36.

The usefulness of rubberlike materials at extremely low temperatures can be established by the recently developed Gehman Flex Test Method (ASTM D1053-52T). Values measured according to this method on an extreme temperature Silastic and a synthetic organic rubber especially compounded for a low temperature service are plotted in Figure 1.



You will note that Silastic does not begin to stiffen until it reaches —50°F, and that it still has a twist value of 13.5 degrees at —130°F. The special low temperature organic rubber loses resilience at +50°F, and will take a twist of only 12 degrees at —22°F.

The usefulness of Silastic on the B-36 is increased by its excellent resistance to oxidation, weathering and to a variety of hot oils. In electrical applications, Silastic stocks are unique even among silicone rubbers for low water absorption and excellent dielectric properties, plus high physical strength.

That kind of performance is typical of Silastic, the Dow Corning silicone rubber. When you need flexibility or good dielectric properties in a resilient material that will withstand years of weathering or long exposure to temperatures far above and below the limits of ordinary rubbers, specify Silastic.

*T. M. REG. U. S. PAT. OFF.

MAIL COUPON TODAY FOR DATA ON THE PROPERTIES OF SILASTIC.

DOW CORNING CORPORATION, Dept. Q-8, Midland, Michigan

Please send me:

- ☐ **Silastic Facts 10a, properties and applications of Silastic stocks and pastes.**
- ☐ **List of Silastic Fabricators.**
- ☐ **"What's A Silicone?", your new 32-page booklet on silicone products and applications.**

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Company_____

Address_____

City_____ **Zone**_____ **State**_____

ATLANTA
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NEW YORK
WASHINGTON, D.C.
(Silver Spring, Md.)

first in silicones

DOW CORNING CORPORATION
Midland, Michigan

These and other B-36 applications for Silastic are more fully described in the March 30, 1953 issue of Aviation Week.

In Canada: Fiberglas Canada Ltd., Toronto **In Great Britain: Midland Silicones Ltd., London**

Temperature Control Units

Sterling, Inc., 3738 N. Holton St., Milwaukee, Wis., has announced the addition of Model 6003 to the Sterlco line of Temperature Control Units. The Model 6003 Temperature Control occupies less than 3 sq ft of floor space. The dual assembly arrangement offers two independent heating, cooling, and circulation systems. Large immersion heaters of 9000 w each are controlled by thermostats in tanks of small total-water capacity.

Optional accessories include 5-in. wheels to adapt it for portable service or a floor stand to raise the unit to convenient height. Primary use is expected in the plastics industry to control mold temperatures, but the control unit is adaptable to other industries where accurate temperature control of dies, molds, printing rollers, etc., is a prime requirement.

Time-Delay Switch

For applications where a mechanically or manually initiated time delay is needed, the Agaswitch has been developed by the AGA Division, Elastic Stop Nut Corp. of America, Elizabeth, N. J. The Agaswitch is operated by a lever rather than by solenoid action as in the case of the Type 2 Agastat. Pressure against the lever trips the switch and a time delay period from 0.1 sec to 5 minutes or more starts upon release of pressure on the lever.

The time delay is obtained by restricting air flow through an adjustable orifice in the timing head. The timing chamber is enclosed and dustproof, with air used for timing recirculated inside.

The Agaswitch is available in both single-pole double-break, and double-pole single-break types, for resistance loads of approximately 15 amp at 115 v, 60 cycles. It measures $2^1/_2$ in. square and 3 in. high.

Air-Flow and Liquid-Level Detector

A new precision flow-detecting instrument, called the Detect-A-Flo, designed to sense and respond to changes or stoppages in the flow of air, has been developed by Fenwal Inc., of Ashland, Mass.

Originally developed to prevent high-capacity aircraft heaters from overheating if their air intakes become clogged, the Detect-A-Flo can be used as a warning device in air-cooled equipment, a ventilation control, and for similar applications where a particular flow rate must be maintained. It may also be used as a liquid-level detector or controller in storage and supply tanks. Viscous fluids, which sometimes affect the accuracy of float-type units, have little or no effect on the operation of the Detect-A-Flo, according to the manufacturer. The unit responds to a change of less than 0.1 in. in liquid level.

The instrument can be set to respond to any mass rate of flow of air in the approximate range of 1000 to 50,000 lb per hr per sq ft. This range corresponds to less than 4 ft to more than 180 ft per sec for flows of standard air.

The maximum dimensions of the unit are approximately 2 by $2^1/_4$ by $5^1/_4$ in.; weight is approximately 8 oz. The heater draws 35 w at 28 v ac or dc; a 115-v model will also be available. The control can handle 5 amp at 115 v ac or 2 amp at 28 v dc. The unit will be made with either a terminal block screw connector or a standard AN connector. Further information about the Detect-A-Flo unit can be obtained from Fenwal, Inc., Ashland, Mass.

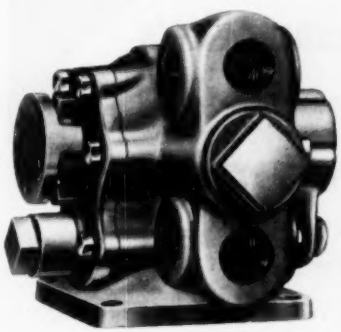
D-C Rectifier Welder

Metal & Thermit Corp., New York, has announced the availability of a new D-C Rectifier Welder in 200-, 300-, and 400-amp ratings. The machine is a heavy-duty unit built for day-in and day-out service in production welding, the manufacturer declares. Its design incorporates fan-forced, up-draft ventilation.

Further information and prices can be obtained from Metal & Thermit Corp., 100 East 42nd St., New York 17, N. Y.

Four-Way Hydraulic Valve

The Cash Standard Four-Way Hydraulic Valve is described in Bulletin S-600, available on request from A. W. Cash Co., Box 551, Decatur, Ill. The valve is designated Type 555-RO and is designed to position double-acting hydraulic cylinders or hydraulic motors.



The operation of the valve is described in sequence with the aid of detailed drawings. A typical hookup is illustrated. Design pressure of the valve is 300 psi to 1500 psi; operating fluid, No. 10 SAE motor oil or hydraulic oil of equal viscosity; capacity, approximately 400 gpm at 1500 psi. A separate pump is needed to supply oil at required pressure.

Turret Indexing Units

Standard, intermittent-motion turret indexing units which provide a basic packaged chassis for a variety of special automatic machines have been announced by Swanson Tool & Machine Products, Inc., Erie, Pa.

Swanson Turret Indexing Units are offered with turret diameters of 20 in., 30 in., or 40 in., for mounting 16, 24, or 32 work stations. Indexing rates are from 547 to 4,700 indexes per hour and dwell time may vary from 0.5 sec to 4.9 sec. Harmonious indexing is accomplished by means of a uniform acceleration cross-over cam, with a locking device.

A mounting ring with a radial keyway is provided below the face of the turret for fastening mounting brackets. These bracket may be fastened in any position around the turret, and are furnished in a variety of widths to support any type of operational device. The stationary center plate, recessed in the top of the turret provides an additional means of mounting or supporting operational devices. Floor base plates can also be furnished for mounting larger apparatus. A totally enclosed fabricated steel base rigidly supports the index box and turret and encloses the motor drive.

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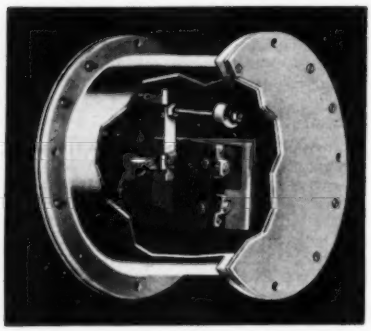
Bin Level-Indicator

An all-new, lower-priced model in the Bantam Bin-Dicator, bin level-indicator, has been announced by The Bin-Dicator Co., 96-13946 Kercheval, Detroit 15, Mich.

The small-size Bantam Bin-Dicator was originally introduced to meet the demand for a unit which could be installed in hoppers, bins, chutes, etc., where installation space was too limited to permit the use of the larger, standard-model Bin-Dicators. The new model is a refinement of the original model and offers even wider versatility and a lower price, the manufacturer states.



Over-all diameter of the new Bantam is $5^3/_4$ in., and the housing is so designed that it may be mounted on the outside of thin-walled bins, inside of thick-walled or multiple-compartment bins, or suspended within bins. The 4-in. flexible diaphragm is ample for the requirements of containers of limited size, and various types of diaphragm material are available, making the Bantam applicable to practically any free-flowing bulk material, according to Bin-Dicator.

Price for the standard model Bantam is $28.00 F.O.B. Lexington, Mich. Shipping weight is about 6 lb. Quantity discounts apply to shipments of 25 or more units sent at one time to one destination.

Seven-Element Automatic Oscillograph

A seven-element automatic oscillograph for recording power-system disturbances and photographically recording preselected magnitudes, wave shapes, and phase relations, has been announced by the General Electric Co.'s Meter and Instrument Dept., Schenectady 5, N. Y.

The new oscillograph, designated GE Type PM-13, has seven permanent-magnetic, fluid-damped galvanometers with a separate shunt and resistor unit for adapting them to current or voltage measurements. Relays and controls are provided for starting the instrument automatically by overcurrent in $^1/_4$ cycle, and stopping it after a predetermined interval or after the fault has cleared.

Including the photographic time recorder, the oscillograph measures 16 in. wide, $23^7/_{16}$ in. high, and $10^3/_4$ in. deep. Studs for switchboard mounting project 3 in. behind the case. Net weight is 95 lb. The case is made of aluminum, with a removable front cover and front relay panel. A small window in the cover permits viewing the lamp and counter. The record chart is bromide paper, $4^1/_4$ in. wide by 200 ft long, and moves at a chart speed rate of 12 in. per sec. Bulletin GEC-396, describing the oscillograph, is obtainable from the company.

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Horizontal Drum Handling Attachment

A horizontal drum handling attachment completely interchangeable among their entire line of fork trucks is now being manufactured by the Clark Equipment Co., Battle Creek, Mich.

The attachment is semi-automatic, and can handle drums ranging in over-all length from 26 to 38 in. Within this range any width likely to be used can be handled. Drums can be handled either empty or full, singly or in pairs. They are projected ahead of the truck directly parallel to the truck's movement. Drums may be tiered or untiered from horizontal nested position unhampered by side or bottom arm projections.

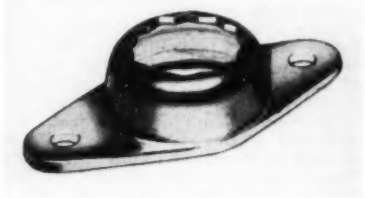
The drum handler consists of two parallel arms with self-actuating levers projecting forward for horizontal drum grasp. Steel channel sections provide maximum rigidity and alignment. Over-all width of the attachment is 26½ in. It weighs approximately 300 lb.

The attachment requires no tools for mounting or dismounting. It is suspended from standard truck forks which are inserted into the two channel-supports forming an integral part of the handler.

The drum handler attachment is available for export sale. Literature is distributed by Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich.

Wrenching-Nut Retainer

Retainers for external wrenching nuts are now in production at Nutt-Shel Co., Inc., Glendale, Cal., according to a company statement. The retainer makes a high-strength anchor nut out of the standard external wrenching nut, Nutt-Shel claims.



Standard anchor nut rivet hole spacing has been adopted to provide interchangeability. It is available for external wrenching nuts with thread sizes ¼–28 through 1–14. Retainer is made of cadmium-plated steel and provides a fastener combination capable of resisting 160,000 psi minimum tensile stress. Complete information is available from R. H. Blakeley, Chief Engineer, Nutt-Shel Co., Inc., 811 Airway, Glendale 1, Cal.

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Aluminum Gas Meter

An aluminum version of its standard No. 1 gas meter has been introduced by Rockwell Mfg. Co. Weighing only 22 lb as compared with the standard meter, which weighs 45, the new meter has been designed to offer increased ease in handling and setting, reduction in shipping costs, and greater resistance to weather and shock.

It has a pressure-cast aluminum body, which offers added protection against the weather. Tested at 10 psi, it has a rated capacity of 5 psi. The meter has a maximum capacity of 275 cu ft per hr, at $^1/_2$-in. pressure drop with 0.60 specific gravity gas; ample, the manufacturer declares, to handle any house heating job. It is available with offset swivels for 10 light meter bar installations. Further information is available from Rockwell Mfg. Co., 400 North Lexington Ave., Pittsburgh 8, Pa.

Fractional-Horsepower V-Pulley

Worthington Corp., has announced a new and improved design for its line of QD Junior fractional-horsepower V-pulleys for mechanical power transmission. The new QD (quick detachable) V-pulleys incorporate many of the advanced design features of the original taper hub pioneered by Worthington for their heavy-duty QD sheaves, according to the announcement.

Basic improvements are centered about a flanged-type split-taper bushing permitting the hub to grip the shaft and still allow easy assembly and removal. The pulley is now a two-piece assembly, drawn together by three slotted hex-head machine screws. Two additional tapped holes allow removal of the pulley from the hub by using the assembly screws as jack screws to break the cone grip. Assembly or removal may be performed with a screw-driver or a wrench.

The new design utilizes one common hub for the complete range of pulleys from 3.5-in. p.d. to 15.4-in. p.d. with a bore range of $^1/_2$ in. through $1^1/_4$ in. by $^1/_{16}$-in. increments. The larger sizes in the line have I-beam arms to give more strength with less weight. For additional information requests should be directed to Worthington Corp., Mechanical Power Transmission Div., Oil City, Pa.

Hermetically Sealed Refrigerant Pump

Heatron, Inc., has announced its Hermetic Refrigerant Pump, a hermetically sealed pump designed to handle the Freon refrigerants in their liquid state. It is being applied to refrigeration recirculating systems to increase efficiency and simplify controls, according to the manufacturer, who further states that it is particularly effective on low-temperature and ultra-low-temperature Freon refrigeration systems.

Single and multiple evaporators may be handled under varying head and flow conditions. A patented oil return feature automatically holds oil concentration in evaporators to a minimum. Eight sizes are available ranging from 4 to 10 gpm against heads up to 50 psi with motors from $^3/_4$ to 3 hp.

These pumps are now available from Heatron, Inc., who have been licensed to manufacture under patents. A four-page bulletin with application drawings, dimensions, and additional data is available from Heatron, Inc., 333 Eberts Lane, York, Pa.

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Self-Aligning Belt Idler

Chain Belt Co. of Milwaukee, Wis., has announced the development of a new belt training (self-aligning) return idler. Identified as the Rex Style No. 41 Roller-Bearing Belt Training Return Idler, it provides automatic alignment for the return belt without the use of side guide idlers.

The idler consists of a dead-shaft roller-bearing return roll, mounted at each end to a toggle-like arrangement of swivel arms suspended from the conveyor framework at an angle of approximately 45 deg in the direction of belt travel.

Lateral movement of the belt to one side results in increased weight on that side which, due to the idler construction, causes that end of the roll to move forward and downward, according to the manufacturer. At the same time, the opposite end of the roll is moved backward and upward and this changing of the normal position of the roll with the belt guides the belt back to the central position.

The idler acts to maintain an equilibrium, with the belt in the center of the roll and the roll in normal position. The action is equally effective on borizontal, inclined, or declined conveyors, Chain-Belt claims, and the effect of build-up of material on the roll is negligible. Because of its principle of operation, this idler operates in one direction only.

Style No. 41 idler is furnished with standard 5- or 6-in. diameter steel return rolls. Style No. 41RC idler, equipped with a standard 5½-in. diameter rubber-covered spiral return roll, can be furnished.

Further details can be obtained from Chain Belt Co., Dept. P. R., Milwaukee 1, Wis.

Slip-Type Clutches for Machine Drives

A line of adjustable torque-limiting clutches that provide overload protection for machine drives in a wide variety of equipment has been announced by Morse Chain Co., 7601 Central Ave., Detroit 10, Mich. The slip-type friction clutches act as automatic shear-pin mechanisms and avoid the time and labor required to insert new shear pins, according to the company.

They are designed to be used in connection with standard Morse Type A plain plate roller chain sprockets. Other types of rotating members such as gears, pulleys, and sheaves can also be used with the new clutches. Morse Standard Torque-Limiting Clutches can be used as overload protection devices in the power drives of conveyors, materials handling equipment and devices, agricultural equipment, packaging machinery, and other related types of equipment where the torque capacity of the drive does not exceed 260 ft-lb.

The clutches consist of a steel body, two steel clutch plates, two friction disks, a Belleville clutch spring, and a cast iron adjusting nut. The rotating member is held between the friction disks through spring pressure exerted on the clutch plates that slide on splines on the hub. The torque setting of the clutch is obtained by adjusting the spring tension with the threaded thumb nut.

Advantages of slip-type torque-limiting friction clutches claimed over shear-pin type overload protection devices are: (1) the overload setting can be readily determined without mutilating a component; (2) the

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clutch is tamper-proof in that the maximum setting cannot be exceeded, as can be done by increasing shear-pin diameters or varying shear-pin material; (3) they are lower in cost than standard roller chain shear-pin sprockets; (4) time losses encountered in repairing shear-pin devices are completely eliminated; and (5) the cost of replacing shear pins is avoided.

Morse Torque-Limiting clutches are mounted on driveshafts with a standard keyway and setscrew arrangement. They are disassembled by removing the adjusting nut, which permits the spring, clutch plates, friction material, and rotating member to be slid off over the hub. In operation, the rotating member on Morse Torque-Limiting Clutches breaks away from the disks at the overload torque setting. Then the rotating member remains stationary in relation to the clutch hub with the friction torque of the clutch remaining at from $^1/_8$ to $^1/_2$ the overload setting. Thus the clutch rotating member is rendered inoperative until the drive is shut off and the overload condition corrected.

The clutches are made in $4^1/_2$-, $5^1/_2$-, and $6^1/_2$-in. diameter sizes with ratings of 55, 121.5, and 260 ft-lb respectively. Maximum bores (with standard keyways) are 1, $1^1/_2$, and $2^1/_2$ inches. Overall lengths are $2^9/_{16}$, 3, and $3^7/_8$ in. Hub OD's are 2.000, 2.625, and 4.250 in.

The $4^1/_2$-in. clutch will accommodate standard $^1/_2$-, $^5/_8$-, and $^3/_4$-in. pitch Type A roller chain sprockets. The $5^1/_2$-in. clutch will handle these sprockets as well as 1-in. pitch sprockets. The $6^1/_2$-in. clutch will take $^1/_2$-, $^5/_8$-, $^3/_4$-, and $1^1/_4$-in. pitch sprockets.

Fork-Lift Truck

A new four-wheel-drive Forkloader with five speeds forward and reverse, designed for heavy-duty operation on rough terrain, mud, snow, and sand has been announced by Baker-Lull Corp.

The new Forkloader is designated the 60N Series and has a lifting capacity of 6000 lb. Use of positive four-wheel drive and large, low-pressure high-flotation tires makes the unit highly effective on nearly any operating surface, according to the manufacturer. A 23-in. oscillation of the rear axle about the longitudinal axis permits four-point traction on rough terrain.

Lifting capacity of 6000 lb is obtained through a hydraulic circuit with 1200 psi working pressure. The entire hydraulic system is pressurized by Baker-Lull gear-type hydraulic pumps. Specially designed hydraulic cylinders, actuated by a heavy-duty control valve, govern tower action. Power for the Forkloader is supplied by Hercules JXD 94-hp gasoline engines or Hercules DJXC 77-hp diesel engines, depending on the Forkloader model specified.

Tower controls are located at the operator's right hand. The operator's seat is located high at the rear of the equipment.

The Baker-Lull 60N Forkloader Series comprises six models: 60N—front-wheel steer, gas powered; 61N—front-wheel steer, diesel powered; 62N—rear-wheel steer, gas powered; 63N—rear-wheel steer, diesel powered; 64—four-wheel steer, gas powered; and 65N—four-wheel steer, diesel powered. Literature and price information on the 60N Series Forkloader is available from Baker-Raulang Co. distributors, or from Dept, KP, Baker-Raulang Co., 1250 W. 80th St., Cleveland 2, Ohio.

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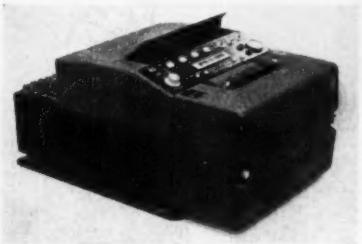
Fifty-Trace Recording Oscillograph

Fifty active data traces can be recorded on 12-in. paper or film by the Type 5-119 Recording Oscillograph, newest of Consolidated Engineering's instrument line, the company has announced. A 36-trace type with identical features is also available. Records 250 ft in length may be made at speeds from 0.10 in. to 100 in. per sec.



Automatic safety circuits are incorporated to give immediate warning should some failure occur to cause record loss. Reserve lamps begin immediate operation in the event of main record lamp failure. Circuits are provided to check condition of the main and reserve lamps, timing lamp, heater operation, and paper supply. Additional test circuits check the warning systems.

Frequencies from 0 to 3000 cps may be recorded by installing Consolidated precision galvanometers. Amplifiers, pickups, and a remote control unit are also available as accessory and associated equipment. Oscillograph models are available for operation from either 26-v d-c or 115-v a-c power.

Record speeds are changed without the use of tools through interchangeable gears, access to which is gained when the magazine is removed. A jump switch increases record speed ten times without stopping the oscillograph, spreading complex wave forms to allow quicker, easier, and more detailed interpretation of data. Narrower paper can also be used in the adjustable magazine. Timing lines are adjustable to full record width or 1 in. at borders at intervals of either 0.01 sec or 0.10 sec between lines.

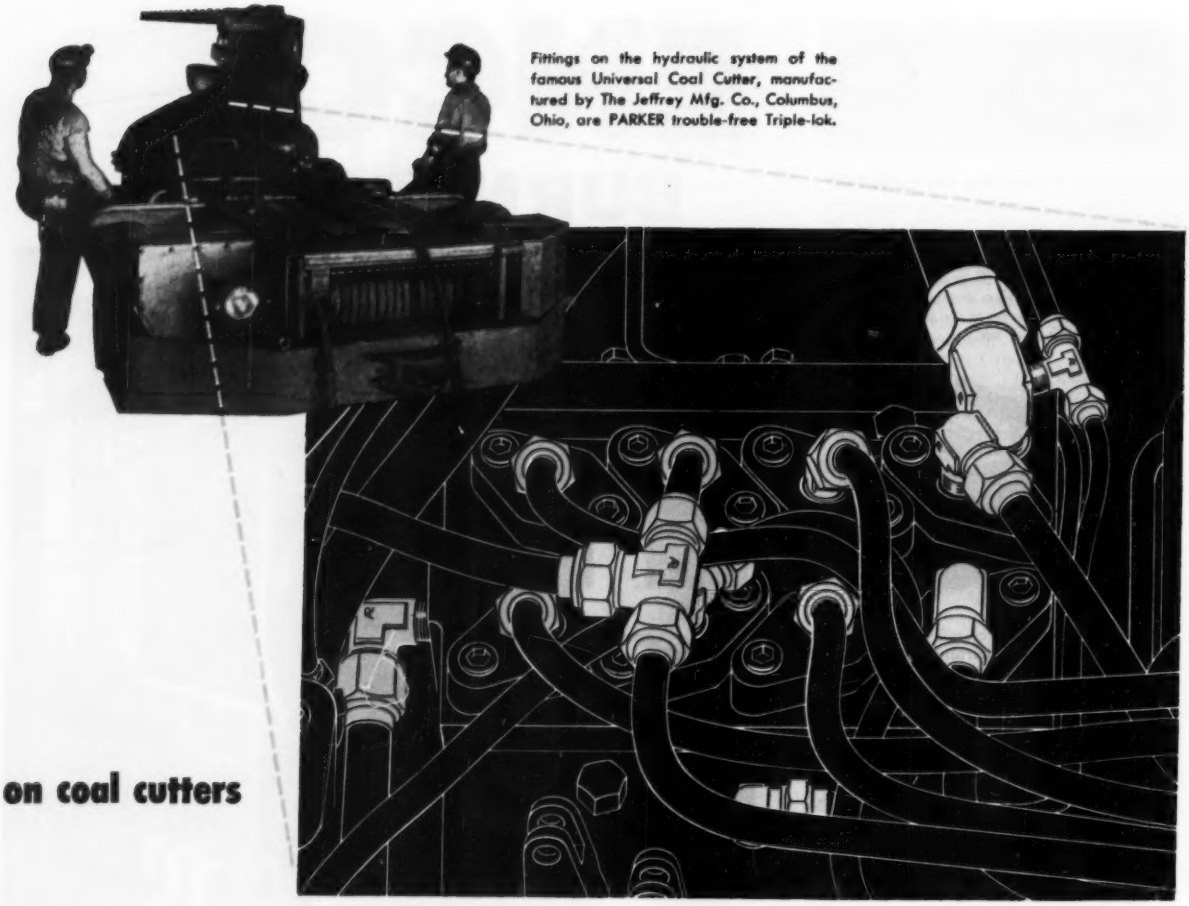
Further information about the 5-119 Oscillograph may be obtained by writing Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 8, Cal., for Bulletin 1536.

Sludge Controller

A sludge controller of the electrical transmission mechanical type has been introduced by the Simplex Valve & Meter Co., Philadelphia 42, Pa. The 8-in. diameter squeeze controller is designed to control the flow of sludge or heavily laden liquids. The device is said to overcome most of the difficulties of regulating heavy viscous flows even if corrosive, without affecting the moving parts of the controlling mechanism.

Its flexible rubber section has no pockets or restrictions which could in any way trap particles of putrescent material since the unit is self-scouring, according to the manufacturer. It can produce a condition of complete cut-off if necessary or of complete wide-open maximum flow conditions.

The core of the device is a time-tested venturi tube with a throat section of flexible rubber. Differential pressure in the venturi is transmitted to a rate setter which measures and maintains the desired flow.



Fittings on the hydraulic system of the famous Universal Coal Cutter, manufactured by The Jeffrey Mfg. Co., Columbus, Ohio, are PARKER trouble-free Triple-lok.

on coal cutters

Tube it up...Forget it...WITH PARKER

TROUBLE-FREE TRIPLE-LOK FITTINGS

Few machines get rougher use than coal cutters in coal mines. Subjected to severe vibration, caused by the action of the cutting head, and operating under the most adverse conditions, all parts must be ruggedly built, including the hydraulic system.

You'll find Parker Triple-lok Fittings on coal cutters and many other machines used in rough, rugged service because they are leakproof under the severest conditions of vibration, elevated temperatures, high pressures and repeated assembly. Parker Fittings meet the specifications of the A.S.M.E. Code for Pressure Piping, as well as J.I.C. and S.A.E. standards.

So *tube it up* and *forget it* . . . with Parker Triple-lok Fittings. Ask your Parker Distributor for Tube Fitting Catalog 4300, or write The PARKER Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio.

This does it

Triple-lok . . . 3-piece flare fitting famous for its sleeve . . . the easiest way to install tubing systems. Made in brass, steel, stainless steel, aluminum alloy.

Precision Mark of

Leakproof Tube Fittings

Parker

TUBE FITTINGS • VALVES • O-RINGS

Plants in Cleveland • Los Angeles • Eaton, Ohio • Berea, Ky.

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Electric Counter

An electric counter similar in design to its manually operated 82-A counter has been introduced by Rockwell Mfg. Co.'s Register Div. A double counter, the new device offers an upper set of figures recording counts up to 999 and a lower set recording counts up to 99,999. A total registered by the upper set may be returned to zero at any time, at the end of a shift or run, or on completion of a count, for example, while the lower set continues to record a grand total. A bell rings at each count.

The counter is especially useful, the manufacturer claims, for fare recording and industrial counting of any sort, particularly in loading operations. Operated by solenoid it can be actuated easily by foot treadle, push button, or electric eye.

The counter weighs 13¼ lb, is 9¼ in. high, 7 in. wide, and 4½ in. from front to back. The upper numerals are ⅞ in. high, the lower 9/16 in. The unit is furnished with a detachable mounting back plate. Further information can be obtained from Rockwell Mfg. Co., 400 North Lexington Ave., Pittsburgh 8, Pa.

Center-to-Center Distance Gage

"Center-Mike" is a special vernier caliper which gives directly the center-to-center distance between two holes, or the distance from the center of a hole to a surface. Operation of the Center-Mike is such that it adds the distances between the far sides and the near sides of the holes, and uses a double-size scale which averages the sum.

Each of three available models has contacts with 0.200-in. diameter, with a supplemental contact with a diameter of 0.060 in. Minimum hole diameter that can be measured is 0.201 in. for the larger contact and 0.061 for the smaller. Center distances that can be measured are: minimum, for all three models, 0.240 in.; maximum, 4.400 in. for Model A4, 7.400 in. for Model A7, and 12.400 in. for Model A12. Additional sizes are being developed, the manufacturer states. A wood case and a tool-steel center-distance standard are supplied with each Center-Mike.

Bulletin 652, describing the Center-Mike, is available on request from Sorenson Center-Mikes, Inc., 264 Kossuth St., Bridgeport 8, Conn.

Flow Meter

The Uehling Instrument Co. has announced a Tel-Flo Meter, designed for measuring flow rates and purging the line. The meter is housed in an aluminum case with a plastic front. It can also be furnished in brass, stainless steel, or other metal bodies.

The Tel-Flo Meter is suitable for maximum pressures of 300 lb, according to the manufacturer, with higher pressure on request. The meter is furnished with or without a control valve, and with either top, side, or back connection.

Drilling and Milling Machine for Connecting Rods

A machine tool capable of drilling and milling 600 automotive connecting rods per hour at 100 per cent efficiency has been announced by The Cross Co., Detroit 7, Mich.

The machine has five stations: one for loading, one for milling the lock slot, and three for drilling the stepped oil hole. Parts are held on a fluid, motor-driven index table. Work holding fixtures are hydraulically operated. The use of pre-set cutting tools reduces downtime and minimizes scrap loss, according to the manufacturer.

Other features include hardened and ground ways, hydraulic feed, and rapid traverse. Hydraulic and electrical construction is to Joint Industry Conference standards.

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Surface-Roughness Tracer

Micrometrical Mfg. Co. has announced the Profilometer Type KC Tracer, for measuring surface roughness on internal tapers, across internal shoulders, and on other surfaces that can only be reached by a Tracer with a dogleg beam. The Tracer can also be used on any other internal or external surface where the geometry of the work permits and where the part can be mounted on a Linear Pilotor with the work surface horizontal, the company states.

Full details and specifications are given in Bulletin LT81, available on request from Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich.

Electric Motor-Pumps

The Oil Hydraulics Div. of the Webster Electric Co., Racine, Wis., has announced that LA and LB Series hydraulic pumps are now available with integral electric-motor drives for low-capacity, low-pressure applications. The design permits use not only with oils but also with other liquids having a substantial oil base.

Capacities range from 0.25 gpm to 4.5 gpm at 100 psi. Maximum working pressures may be increased to 200 psi with power requirements not to exceed $\frac{1}{2}$ hp. Optional internal relief valves make it possible to vary relief pressures between 50 and 200 psi with a manual adjustment.

More information will be sent by the Oil Hydraulics Div. of the Webster Electric Co., 1900 Clark St., Racine, Wis., upon request for Bulletin J-A1.

Furnace and Boiler Cleaner

A furnace and boiler cleaner, designed to increase efficiency of all types of industrial and commercial heating systems, has been announced by Premier Co., St. Paul, Minn. Designated Model P-908F, the unit is an efficient aid in cleaning the entire heating system, the manufacturer says.

The Premier Furnace and Boiler Cleaner has a 1-hp, 115-v, a-c/d-c motor. Its filter is made from specially woven fabric to permit a minimum of back pressure while providing 1625 sq in. of filtering area. The bag has a positive locking coupling with a clamp to allow cleaning.

The container has a capacity of 1.04 bushels. Dimensions of the unit are: height, $32\frac{1}{2}$ in.; width, $21\frac{1}{4}$ in.; tank diameter, 17 in. Weight is 43 lb; shipping weight approximately 74 lb. Rubber tread casters with top swivel bearings permit rolling of the unit. Also provided is a 22-ft heavy-duty, three-conductor, rubber-covered cord with protective ground wiring.

Standard cleaning tools furnished with the P-908F include a 10-ft rubber hose and adapter, 6-ft metal hose, utility nozzle, slide-on brush, wire brush, rubber blower and suction tool, hose and blower coupling, screen guard, scraper nozzle, and straight flat tube. Also available is a complete set of attachments for cleaning flues, air ducts, and chimneys.

A special design feature of the equipment enables the motor unit to be used separately as a blower or hand cleaner. Tools are furnished with the unit for its conversion to a blower, and additional equipment is available to convert it for use as a heavy-duty hand cleaner. Complete details and prices on the Premier Furnace and Boiler Cleaner may be obtained from Dept. KP, Premier Co., 755 Woodlawn Ave., St. Paul 1, Minn.

Industrial Fuel-Burning System

A completely factory-coordinated industrial fuel-burning system, said to make available for the first time a packaged system for the conversion of large boilers to oil or gas firing, has been developed by the Industrial Div. of York-Shipley, Inc., York, Pa.

The York-Shipley F/C is a complete factory-coordinated (factory engineered, factory planned, factory processed) industrial fuel-burning system. Built around the York-Power burner for oil or gas firing, the F/C system includes proper controls mounted in panels and wired to terminal strips for easy connection, factory-engineered windbox assembly and refractory ring, fuel-oil heaters, and trim.

The elements of the York-Shipley F/C system include: (1) York Rotary Burners, oil or oil/gas-fired, supplied in a range of sizes from 18 to 400 hp; (2) F/C Windbox Assembly, a factory prefabricated unit of heavy boiler plate sized to provide the secondary air for fuel burning, with all burner mounting holes cut; (3) F/C Combustion Refractory Ring for installation behind the windbox in the combustion chamber; (4) F/C Factory-Wired Control Panels: a main control panel for primary burner and flame control, an induced-draft-fan panel, master and draft controls, and a stock thermometer and draft indicator panel; (5) F/C Tank Heater for recovering hot oil being returned by burner and preheating oil in tank; (6) F/C Fuel-Oil Pump Sets; (7) F/C Fuel-Oil Heater Assemblies of either below-the-waterline or steam type; and (8) F/C Trim Assembly of valves and gages for suction and discharge piping at burner.

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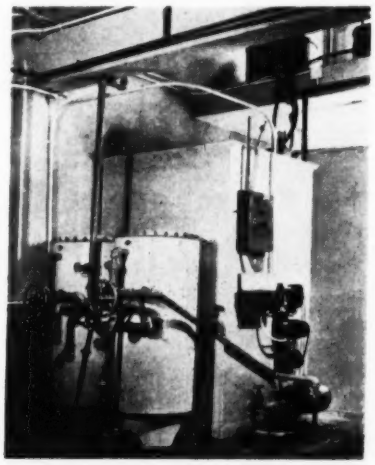
Package Water-Conditioner

The Permutit Package Water-Conditioning Plant has been announced by The Permutit Co., 330 West 42nd St., New York 36, N. Y. These units, without any alterations, according to the manufacturer, may be used (1) to remove turbidity, color, and organic matter from water supplies; (2) to chlorinate; (3) to remove bad tastes and odors; (4) to remove iron and manganese; (5) to neutralize; (6) to soften; and (7) to de-alkalize.



The plant, as a complete package, forms a versatile and self-contained unit which is available in eight standard sizes ranging from 500 to 3,300 gpm and flows of 12,000 to 79,200 gal per 24 hr. Larger capacities can be furnished on request. Each complete water conditioner consists of a precipitator with a built-in clearwell, a proportioning chemical feeder control, a coagulant feeder tank, a lime or soda ash and hypochlorite feeder tank, an inlet float control valve, one or more Neutralite filter units, one or more Carbo-Dur purifier units, and a service pump.

Four-Way Pneumatic Valves

Airelectric Corp., Melrose, Park, Ill., has announced a line of 4-way valves for operation of pneumatic and light-hydraulic cylinders. These valves are of D-slide type, with the port-exchanger slide being operated by a double-acting cylinder in one series and by a spring-return cylinder in another series.

The company claims extremely high durability of the valve units due to choice of materials in the design. The Nylon port exchanger has been service tested to 50,000,000 cycles and found to be undamaged, as was the pilot cylinder assembly which is of hard-surfaced aluminum. Valves can be operated without lubrication where the application dictates oilless operation, according to Airelectric. Valves operate on pressures from 3 to 200 psi.

A feature of the valve is the cost of a complete service overhaul. A standard price of 50 cents will be maintained by the company for the Nylon port exchanger. With this replacement, a simple hand-lapping of the valve port block will renew the valve for years of further service.

All of the valves can be operated manually or electrically by interchanging the operating valve units. The company also will offer operating valves for these pilot valves, a line of speed controls, and reusable fittings and hose. The manual operating valves can be used for push-button starting or as air limit switches for automatic return of cylinder piston.

The valves are small, $2\frac{1}{2} \times 2\frac{1}{2} \times 2$ in. in size, although capable of delivering media from full $\frac{1}{4}$-in. and $\frac{3}{8}$-in. orifices. The valves are ported with cylinder ports at 90 deg so that valves can be mounted directly to rear or side ports of cylinders.

Ball Detent Hydraulic Valve

A new hydraulic four-way valve with ball detents is being offered by Rivett Lathe & Grinder, Inc., Boston, Mass. The locking action of the new detent permits the valve to be mounted vertically as well as horizontally, Rivett claims.

The valve is available with one, two, or three ball detents; with one detent the valve piston is held in center position; with two detents the valve piston is held in either end position; with three detents the valve piston is held in both end and center positions.

Designed for 1500 psi pressure, the Rivett ball detent valves are offered in three different types of operation: threaded stem, lever, and knob; in seven sizes: $\frac{1}{4}$ in., $\frac{3}{8}$ in., $\frac{1}{2}$ in., $\frac{3}{4}$ in., 1 in., $1\frac{1}{4}$ in., and $1\frac{1}{2}$ in.; and in five piston designs. The 28-page Catalog 204, can be obtained from Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.

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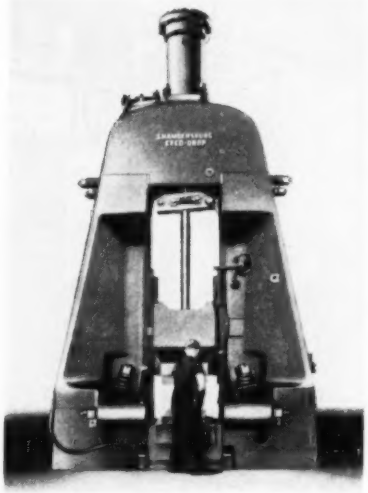
Gravity-Drop Hammer

The shipment of a 6000-lb Ceco-Drop Hammer to Westinghouse's Steam Turbine Div. in South Philadelphia marks the completion of the largest Ceco-Drop ever built by Chambersburg Engineering Co., Chambersburg, Pa. Four other Ceco-Drops ranging in size from 2500 to 5000 lb are already in use at the Westinghouse plant.



The significance of the 6000-lb gravity-drop hammer is that the piston-lift, gravity-drop type of hammer removes the limitations of size common to the board-drop hammer and extends the range of falling weights practical for gravity-drop hammers, Chambersburg declares. Announcement is also made by Chambersburg of an 8000-lb Ceco-Drop under construction in England for use in that country.

Black Granite Layout Plate

A line of black granite Layout Plates has been developed to supplement Surface Plates manufactured by Collins Microflat Co. Differing from surface plates, the layout models do not have clamping edges, but are straight-sided. By eliminating sawing of edges for clamping purposes, and allowing more tolerance, the manufacturer reports that he is able to produce the plates at a lower cost.

The surfaces of the layout models are finished to an accuracy up to 0.0002 in. per ft, whereas the surfaces of Microflat Surface Plates are finished up to 50 millionths overall. They have the same advantages as the regular line of Collins precision two- and four-clamp edge surface plates. They are non-rusting, non-warping, non-deflecting, washable, smooth, temperature-inert, rigid overall, and moisture repellent. The Layout Plates, being black granite, have no glare. They require no oiling and cannot corrode. If accidentally nicked, the surface accuracy is not impaired, as the surface will not rise around the nick.

A bulletin describing the Layout Plates and listing sizes from 12×18 in. to 36×48 in. can be obtained from Collins Microflat Co., 2326 E. 8th St., Los Angeles 21, Cal.

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Radiation Detector

Self-contained and requiring neither batteries nor external charging devices, Consolidated Engineering Corp.'s Gamatek Radiation Detector is now available in limited quantities for immediate delivery. Acting as a "dosimeter," the pocket-size instrument accurately indicates on a direct-reading scale the total dosage of gamma and X-rays to which a body or area has been subjected. By observing the time the needle takes to move across the scale and referring to a table printed on the back, the Gamatek can be used as a radiation ratemeter. It is designed for monitoring in atomic research, medical and industrial radiology, and radio-isotope applications.

Full-scale reading is 250 milliroentgens. The dial permits reading total dosage in smaller increments. The instrument is zeroed by an integral friction charger operated through an external knob. Constructed of inert materials, having no batteries, and tightly sealed, it is highly stable and reliable, the manufacturer states.

A 4-page descriptive folder on the Gamatek will be sent on request for Bulletin CEC-1008 from Consolidated Engineering Corp., 300 North Sierra Madre Villa, Pasadena 15, Cal.

BUSINESS NOTES

GE Establishes New Motor Department

The establishment of a Direct-Current Motor and Generator Dept. in the General Electric Co. has been announced by James M. Crawford, vice-president and general manager of the GE Motor and Generator Div.

Oscar L. Dunn, appointed general manager of the new department, which will be located in Erie, Pa., explained that it will assume all duties and responsibilities of the Company's former D-C Motor and Generator Planning Study. In addition, he said, the department will have responsibility for the d-c and synchronous motor and generator lines which are now manufactured by the company's Large Motor and Generator Dept. at Fort Wayne, Ind., and the armored motor line produced at Erie by the Medium Induction Motor Dept.

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Insul-Mastic Signs Two Licensees

A western and a southern insulation contractor have accepted licensee contracts with the Insul-Mastic Corp. of America. The companies are The Starr Davis Company, Inc., Greensboro, N. C., and the Plant Asbestos Co. of Emeryville, Cal.

Insul-Mastic produces heavy mastic coatings for the vaporsealing of insulation, for waterproofing masonry, and for corrosion prevention. The two contracting firms will act as applicators and distributors.

Clark to Handle Ross Line

Clark Equipment Co. has revamped and expanded its dealer organization in the midwest and on the west coast to handle its newly acquired Ross straddle-truck and fork-truck lines, according to an announcement by W. E. Schirmer, vice president. Clark Equipment Co. acquired The Ross Carrier Co. in May, 1953.

Newly appointed dealers who will handle the expanded Clark line include the Robert H. Dodd Equipment Co., Portland, Ore., and the Christy Equipment Co., Omaha, Neb.

Instrument-Tubing Support

Announcement of the formation of Instrof, Inc., has been made by Edgar W. Baird, Jr., president of the new corporation. With offices and plant located at 4923 Pentridge St., Philadelphia 43, Pa., the company will manufacture and sell Instrof, a completely fabricated system of flattened, expanded steel trough and fittings for the continuous support of instrument tubing. Instrof eliminates costly engineering detail, field fabrication, and clamp installation, according to the firm. William S. Taylor, sales manager, is appointing representatives in industrial areas throughout the country.

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Rust-Oleum Appoints Distributors

The Rust-Oleum Corp., 2799 Oakton St., Evanston, Ill., has announced the addition of two new industrial distributors to its nation-wide distributor sales organization.

The two newly appointed distributor firms are: Seaboard Mill Supply Co., 294 Jersey Ave., New Brunswick, N. J.; and E. Blankenship & Co., Inc., 704 West Main St., Marion, Ill.

Parker Changes Status of Subsidiary

The Parker Appliance Co., Cleveland, Ohio, announces that as of July 1 the operations of its subsidiary Synthetic Rubber Products Co. of Los Angeles, Cal., are being merged with those of Parker's Rubber Products Div. Henceforth, the Los Angeles facility will be known as the Rubber Products Div., Parker Appliance Co., 1538 South Eastern Ave., Los Angeles 22, Cal.

The change in the official status of the Los Angeles facility in no way alters its function, and it will continue to operate the same as in the past, receiving orders for Parker rubber products from west coast customers.

Working Model of Fully Automatic Elevators

A scale model of a four-car elevator bank in a ten-story building has been built by the elevator division of Westinghouse Electric Corp., Pittsburgh 30, Pa., to demonstrate its new automatic traffic pattern elevator system. Automatic traffic pattern, which Westinghouse estimates saves $7,000 per year per car over older systems, is a completely automatic system which operates a bank of elevators without attendants of any sort.

Shown for the first time at the 46th Annual Convention of the National Association of Building Owners and Managers in Pittsburgh on June 8-12, the working model performs precisely as would a true automatic traffic pattern system serving a ten-story 900-occupant building. Built on a scale of ½ in. to 1 ft, it has over 420 electrical circuits which relay information to and from the electronic "brain" of the system. The brain, very similar to the brain of a full-size automatic traffic pattern system, receives such information as the number of car calls registered in each car, the number of corridor calls and their locations, the load in each car, the number of stops it has made, the amount of time it is spending at the terminals, and other information. Taking this information, the brain sets up the best traffic pattern, forces the cars as a team to follow this pattern, and otherwise controls every component of the system.

Within a 20-minute cycle, the model goes through the typical traffic patterns that would occur in a ten-story, 900-occupant building in a day's time. Moving lights on the floor of the simulated building lobby trace an office worker's path as he enters the building and approaches the model bank of elevators. When the passenger enters the car, as indicated by a light in the rear of the car, another light flashes indicating that his floor selection has been registered. Cars are dispatched from the main floor at periodic intervals determined by a sweep-second timing clock. The model will be shown at Westinghouse district offices in other key cities around the country.

A-C Opens Des Moines Branch

A Des Moines, Iowa, branch office has been opened by the general machinery division of Allis-Chalmers Mfg. Co. in the Savings & Loan Bldg., 206 Sixth Ave.

The new branch is under the management of Edward A. Rensch, who has been a sales representative in the company's Davenport office, now a district office. The Davenport office continues under the management of Albert W. Kremser, who has been in charge there since 1945.

Quaid Fabrications Expands Facilities

Quaid Fabrications, Inc., 157-167 W. Oxford St., Philadelphia, Pa., has expanded its administrative, engineering, and sales facilities with the acquisition of an additional building adjoining its plant, it has been announced by James A. Quaid, president.

The company fabricates stainless steel and alloy equipment and assemblies for a wide range of industrial uses.

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Foxboro Establishes Firm in Mexico

The Foxboro Co., Foxboro, Mass., has announced the organization of a Mexican affiliate, Graficas e Instrumentos, S. A. The new concern has obtained factory facilities adjacent to Schultz y Cia., Foxboro's sales representatives in Mexico. Already in full production is the chart department, printing Foxboro precision charts for all types of recording instruments. The Mexican company is the third to join the list of Foxboro's international affiliates.

Yale & Towne Announces Syracuse Distributor

The appointment of the Materials Handling Products Corp. of Syracuse, N. Y., as distributors of Yale Industrial Truck products has been announced by James H. W. Conklin, general sales manager of The Yale Materials Handling Div. of the Yale & Towne Mfg. Co., Philadelphia, Pa.

The main office of the Materials Handling Products Corp. is 2704 Erie Blvd., East, Syracuse. Branch offices are in Schenectady and Utica.

LATEST CATALOGS

Water-Treating Equipment

The American Water Softener Co., Inc., has published four booklets on water-treating equipment. Booklet 300 describes the American Chloride Dealkalizer, which reduces alkalinity by chloride anion exchange. Advantages claimed for the American process over conventional processes are increased capacity, reduced operating cost, reduced alkalinity leakage, elimination of the need for special corrosion-resistant equipment, and reduction of silica.

American Spray-Atomizing-Type Deaerators are covered in Booklet 400. This deaerator is recommended by the manufacturer for turbid waters and waters that have chemical characteristics which would tend to clog or corrode a tray deaerator. Internal plate fabrication in contact with highly corrosive vapors is of stainless steel. The compound inlet water spray nozzle and the steam-atomizing valve are cast bronze.

Bulletin 400A concerns American Jet-Tray Deaerators, recommended for applications requiring most complete deaeration. Internal plate fabrication is of stainless steel where in contact with highly corrosive vapors, as are the tubular deaerating elements. The compound water-inlet spray nozzle is of cast bronze.

The American Cycloflow Valve, Bulletin 600, is a four-position single-control valve for controlling the flow through ion-exchange equipment. Backwash, regenerant introduction and displacement, rinse, and service operations are provided by the valve. The valve is an assembly of hydraulically actuated, single-seated poppet valves constructed in balanced pairs. The valve body is made of either cast iron or inert plastic (Plexiglas, Lucite, or Uscolite), for non-corrosive or corrosive applications respectively.

Copies may be obtained from the American Water Softener Co., Inc., Fourth and Lehigh Ave., Philadelphia 33, Pa.

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Turret Lathe

Catalog No. 5312 illustrating the 16-in. swing 2-H South Bend Turret lathe is now available, the South Bend Lathe Works has announced. This lathe has $1^3/_8$-in. spindle bore with a 1-in. collet capacity. There are both action views of the lathe and views of its outstanding mechanical features. With complete specifications and explanative copy, this new two-color catalog provides four full pages on the production turret lathe. Attachments and accessories which add to the versatility of the turret lathe are either illustrated or listed. Copies on request from South Bend Lathe Works, 425 East Madison St., South Bend 22, Ind.

Wool Felt

American Felt Co. has issued a catalog of the Commercial Standard 185-53 wool felt, containing 47 reference samples divided into three classifications. Sixteen different types of mechanical roll felts, 18 types of sheet felts, and 13 types of roll felts for the apparel and decorative trades are shown.

The catalog has been prepared in conformity with a United States Government bulletin, "Commercial Standard 185-52 Wool Felt—A Recorded Voluntary Standard of the Trade," prepared by the United States Dept. of Commerce in cooperation with the National Bureau of Standards. The bulletin, which is stitched into the catalog, states that, "Simplified Practice Recommendations and Commercial Standards and Test Methods are developed by manufacturers, distributors, and users in cooperation with the Commodity Standards Division of the Office of Industry and Commerce, Bureau of Foreign and Domestic Commerce, and with the National Bureau of Standards.

"The adoption and use of a Simplified Practice Recommendation or a Commercial Standard is voluntary. However, when reference to a Commercial Standard is made in contracts, labels, invoices, or advertising literature, the provisions of the standard are enforceable through usual legal channels as a part of the sales contract."

Gear Pumps

Bulletin 17-A on gear pumps has been published by Schutte & Koerting Co., Cornwells Heights, Bucks County, Pa. The 24-page, two-color bulletin describes all SK standard pumps, and illustrates and briefly describes some of the special types engineered to meet unusual requirements.

The design, construction, and operation of these units are described, as well as their uses in many industrial fields: petroleum, petrochemical, power, food, textile, and others. Information explaining how to select the proper pump for a specific application is included.

The bulletin uses cut-away drawings, dimension drawings, photos of pumps in action, tables of capacities, pressures, dimensions, and operational data to supplement the text. The pumps are designed to handle material with viscosity ranges from 30 to 10,000,000 SSU or capacities from 1 gph to 1000 gpm, or to operate against back pressures up to 3500 psi. Copies may be obtained upon request from Dept. P-E, Schutte & Koerting Co., Cornwells Heights, Bucks County, Pa.

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Hydraulic Pumps and Controls

Vickers, Inc., has released Catalog No. 5001, describing and giving specifications for Vickers pumps, valves, cylinders, power units, transmissions, and control devices for oil hydraulic operation of industrial machinery. Cutaway drawings illustrate features of the Vickers equipment.

Copies are available on request from E. O. Clark, Sales Mgr., Industrial Products, Vickers, Inc., 1500 Oakman Blvd., Detroit 32, Mich.

Materials Handling Equipment

A comprehensive line of equipment for the "floor-level" handling of goods and materials is presented in the Barrett Junior Catalog, No. 535, recently released.

The 100-page eleventh edition of this pocket size catalog contains information, illustrations, and specifications on fork trucks, high-lift electric trucks, pallet trucks, industrial tractors, electric- and hand-lift trucks, steel-leg skids, semi-live skids and lifters, portable and industrial elevators, portable cranes, stacking frames, steel storage racks, lifting and die tables, hand trucks, and handling specialties.

Junior Catalog No. 535 will be mailed upon request by Barrett-Cravens Co., 4609 S. Western Blvd., Chicago 9, Ill.

Valve Lubrication

A 12-page bulletin describing lubricants, lubricant fittings, and lubrication methods for Rockwell-built Nordstrom valves has been issued by Rockwell Mfg. Co. Three major types of lubricant, Rockwell Hypermatic, Nordcoseal, and Lubricant DC-234, are described. Their functions are listed in detail. A "selection chart" is also offered showing which lubricants are recommended for use with a variety of fluids.

The bulletin also illustrates and briefly describes the new Rockwell bulk and gun tube lubricants along with stick lubricants, bulk lubricant cans, and Hypreseal stem packing for use in the packing injector fittings of Nordstrom Hypreseal valves. Bulletin V-220 is available from Rockwell Mfg. Co., 400 North Lexington Ave., Pittsburgh 8, Pa.

A-C Motor Starters

Allis-Chalmers size 0-3 a-c across-the-line motor starters are described in a new eight-page bulletin released by the company. The bulletin covers manual and magnetic types of starters, and combination and reversing starters as well as push-button control stations. Operating arrangements are described and six types of enclosures, general purpose, water-tight, dust-tight, hazardous-dust location, hazardous-gas location, and open, are given.

According to the bulletin, all starters are equipped with thermal overload protection devices and the magnetic starters can be connected for either low-voltage protection or low-voltage release. A table shows motor voltage and motor maximum hp (3 phase) applicable to each of the four NEMA sizes of starters described.

Copies of the bulletin, "Allis-Chalmers Size 0-3 Alternating Current Across-the-Line Motor Starters," 14B7132A, are available on request from Allis-Chalmers Mfg. Co., 949 S. 70th St., Milwaukee, Wis.

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Preheat Calculator

The Lincoln Electric Co., has re-issued its Welding Preheat and Interpass Temperature Calculator. It now is in accordance with latest welding practices, Lincoln states. The calculator uses slide-rule principles to permit calculation of the preheat and interpass temperature required when the hardening or cracking tendency of metal being welded can be minimized by preheating.

Experience indicates that in some cases best quality welds in high carbon and some alloy steels are obtained by using preheat. The amount of preheat will vary depending on the chemical analysis of the metal and the thickness. When the analysis and thickness are known, the calculator, working from this information, gives the amount of preheat required for a satisfactory welding procedure. The percentage present of elements such as carbon, manganese, silicon, phosphorus chromium, nickel, molybdenum, vanadium, and copper are worked into the calculation along with metal thickness ranging from $\frac{1}{2}$ in. to 10 in. Price is $0.50 in the United States, $0.75 elsewhere, from The Lincoln Electric Co., Cleveland 17, Ohio.

Grooving Tool

Completion of a 20-page descriptive catalog covering its Waldes Truarc Grooving Tool has been announced by Waldes Kohinoor, Inc., Long Island City, N.Y. According to Harold F. Bower, Truarc sales manager, the manual is one of the most complete reference catalogs on the cutting of internal recesses ever published.

Among the subjects covered in detail in the catalog are: cutting ranges, giving data showing how the tools can cut accurate grooves in housings and bores from .250 in. to 5.000 in.; accessory parts, describing different types of cutters: single, multiple, beveled and special profile; use of the tool, showing how to locate grooves in different types of bores, in blind holes, under varying conditions; seventeen case histories describing typical industrial problems and how Waldes Truarc Grooving Tool has solved them.

The manual explains selection of the right model tool for particular operations and supplies data on adjustment and maintenance and replacement parts. Copies of the manual are available without charge upon request from Truarc Catalog Service, Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.

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Cemented Carbides

A special condensed price list and catalog, GT-265, the "Brief-A-Log," which includes details on all new price adjustments and specifications of its standard cemented carbide tools and blanks, is announced by the Carboloy Dept. of the General Electric Co.

Besides listing the products affected by recent price cuts, and the new lower prices, the 20-page "executive's briefer" provides essential buying information required in specifying cemented carbide tools and blanks.

Solenoid-Operated Lubricator

The Bijur Lubricating Corp., Rochelle Park, N. J., has published a bulletin on the operation and application of the company's new Type "E" Solenoid-Operated Lubricator.

The new unit, as described in Bulletin NB-11, is adaptable to many types of machines, and offers wide flexibility of control, Bijur claims. Use of the lubricator in printing presses and brick-forming presses, is also discussed. The two-color folder may be had by writing directly to the manufacturer.

Pneumatic Spreader Stoker

A 12-page, four-color catalog, Form 2530, describes the Iron Fireman Pneumatic Spreader Stoker, Series 401. The stokers are designed for bituminous, sub-bituminous, high ash fuion , and lignite coals.

Features of the stoker are illustrated and its advantages explained. Cutaway drawings aid in the step-by-step explanation of pneumatic spreader firing. Material on automatic combustion controls, dumping grates, and fly ash reinjection system is included, with photographs of installations. The catalog will be sent at no charge by the Iron Fireman Mfg. Co., Cleveland 11, Ohio.

Materials Handling System

A two-color illustrated booklet showing different units in the Work-O-Matic material handling system has just been published by The Union Metal Mfg. Co., of Canton, Ohio.

On-the-job photographs show material positioning with bin boxes and gravity-fed hoppers, and tiering, storing, and dumping with multi-duty boxes and trays. Picture stories describe how end-loading scoops and multi-duty trays operate in integrating production, storage, material movement, and disposal. The new booklet is 12 pages, $8^1/_2 \times 11$ in. Copies may be obtained by writing Union Metal Mfg. Co., Dept. PR, Canton, Ohio.

Duct Size Calculator

The Ducon Co., Mineola, N. Y., manufacturers of dust-control systems and equipment, have prepared a Duct Size Calculator in the form of a heavy cardboard slide rule.

The Calculator has four scales. One scale permits direct reading of duct diameter for a desired velocity when the slide is set at the necessary number of cubic feet per minute to be handled. A second scale gives the friction loss per 100 ft for a given duct diameter when the slide is set for the desired velocity. The third scale, when the slide is set at the diameter of a round duct, shows the rectangular duct width needed with a rectangular duct depth to result in the same area. The fourth scale is a simple conversion scale for a round duct, giving the number of square feet of area for round duct diameters.

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Packaged Automatic Boilers

Bulletin 1219 describes Orr & Sembower Powermaster packaged automatic boilers in seventeen sizes from 15 through 500 hp, for steam process as well as steam- and hot-water-heating service. The first part of the bulletin describes the advantages of packaged automatic boilers contrasted with equipment of conventional design. Construction and operation advantages of Powermaster such as 3-pass design, forced draft, and controls, are described and pictured. The firing equipment for light and heavy oils as well as gas is described in the Orr & Sembower Viroflow air-atomizing oil burner design and pre-mix gas burner designs. Detailed specifications describe the boiler, burner, and control systems. A 350-hp model has been added to the line.

Orr & Sembower, Inc., Morgantown Road, Reading, Pa., will send a copy of Bulletin 1219 on request.

Combustion Gas Turbines

A 24-page booklet on combustion gas turbine power plants for mechanical drive applications is available from the Westinghouse Electric Corp. Combustion gas turbines can mean savings in installation operation and maintenance costs for natural gas transmission, and in the chemical, refinery, steel mill, and many other process industries.

The booklet describes four types manufactured by Westinghouse: 1800-hp, simple open-cycle; 5000-hp, compound open-cycle with regenerator; 5300-hp compound open-cycle; and 7000-hp simple open-cycle. Load diagrams, dimensioned outline drawings, performance curves, and colored cutaway drawings are presented for each type. Sample calculations show how to use the curves to determine various engineering data.

The booklet also describes design and structural features, and includes detailed information on the air compressor rotor and casing, gas turbine rotor and casing, combustion system, auxiliary assembly, control panel, and double helical gears. Twelve factors to be considered in selecting a combustion gas turbine power plant for mechanical drive service are listed. The booklet, B-5859, is available from Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

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Plant Interior and Machinery Colors

A six-page color-chip folder, Form No. 125, illustrating and describing the new Rust-Oleum Restful Color Group for plant interiors and machinery, has been released by Rust-Oleum Corp.

The Restful Color Group is specially prepared to assure pleasing colors and harmony in contrasts, Rust-Oleum declares. Machinery finishes include 842 Grandeur Gray, 840 Harmony Green, 844 Crescent Ivory and 848 Pleasant Green. Restful Color Group finishes for walls, ceilings, etc., include 831 Restful Green, 835 Cosmic Gray, 837 Sun-Glo, and 839 Vertex Green. For further information on the new Rust-Oleum Restful Color Group with color-chip literature, Form No. 125 can be obtained from the Rust-Oleum Corp., 2799 Oakton St., Evanston, Ill.

Corrosion Resistance of Copper

For twenty-seven years, laboratory research and field study of the nature of corrosive attack on copper and copper alloys have been conducted by The American Brass Co.'s technical staff. The results of this study have recently been brought up to date in a new 28-page booklet, "Corrosion Resistance of Copper and Copper Alloys." The publication explains the chemical and physical nature of corrosive attack in its various forms.

Included is a tabulation indicating the relative corrosion resistance of the principal types of copper and copper base alloys when in contact with 183 different corroding agents. In the recently released, revised edition, more complete information has been added on stress-corrosion cracking, galvanic corrosion, and fresh and salt water corrosion. A section has been added on the subject of atmospheric corrosion. The section on corrosion in petroleum refineries has been completely revised. The booklet, Publication B-36R, is available without charge from The American Brass Co., Waterbury 20, Conn.

Orifice Meters

A 28-page bulletin describing Rockwell "201" orifice meters has been issued by Rockwell Mfg. Co. Featured in the new bulletin are 3½ pages of tables giving representative orifice capacities. With the aid of full-page front and rear view sectional photographs, the bulletin shows how the "201" meters are constructed and how they operate.

Photo-illustrated descriptions of manifold arrangements and differential ranges available also are given, along with pictures and drawings of various elements of the meters to illustrate specific design features. A page of drawings shows how the meters are used with liquid seal chambers and piping for steam, corrosive gases, and liquids. Complete specifications are offered for meter mountings and manifold, straightening vanes, forged steel orifice flange unions, and ring-type joints.

Other features of the bulletin include a page of general instructions for meter servicing, and a page describing meter testing and operating practice, square root charts, and instructions for testing differential.

For Consulting Engineers Turn to Page 132

KEEP INFORMED

NEW EQUIPMENT | BUSINESS NOTES | LATEST CATALOGS

Furnace Control Instruments

A new catalog of control instruments for furnaces, ovens, dryers, and kilns has just been published by The Bristol Co., Waterbury, Conn. The catalog, No. P1255, features Electronic Dynamaster potentiometer- and millivoltmeter-type pyrometer controllers, recorders, and indicators. A variety of electric, air-operated, and electronic control instruments for use with fuel-fired and electric heating equipment of all types is listed. Engineering specifications and prices are given. In addition to photographs, the catalog is illustrated with diagrams of the various control arrangements and dimension sketches. Copies are available on request from The Bristol Co., Waterbury 20, Conn.

Screw Pumps

The Warren Steam Pump Co., Inc., offers two bulletins on its line of screw pumps. Bulletin S-205 covers three types: Standard Gear-in-Head, High-Pressure Long-Body Gear-in-Head, and Standard Vertical Gear-in-Head. Basic construction and design are discussed in detail, with sectional views indicating features of the pumps included. External and installation illustrations, dimensions, and specifications are also given.

Bulletin S-206 concerns Double External Bearing and Gear Screw Pumps and Double External Bearing and Gear Hopper Pumps. Construction features, dimensions, and specifications are discussed. Both bulletins are available on request from the company.

Industrial Furnaces

"'Surface' Standard Rated Industrial Furnaces" describes and gives temperature ranges for prepared-atmosphere furnaces, oven furnaces, laboratory furnaces, atmosphere generators, forge furnaces, pot furnaces, and several others. The number of the specification sheet on which can be found additional data on any given type of furnace is included. Copies of the leaflet, Form SC-141, are available from Surface Combustion Corp., Toledo 1, Ohio.

Chains, Sprockets, Idlers, and Nozzles

An Abbreviated Catalog on Rex Cast and Steel Chain, Cast-Tooth Sprockets, Belt-Conveyor Idlers, and Spray Nozzles, Bulletin No. 53-110, has been released by Chain Belt Co. of Milwaukee, Wis. It is intended for designers of equipment using sprocket chains and power transmission machinery, and purchasers of this material.

The 56-page book has a pictorial index on the inside front cover. The story of corrosion- and abrasion-resistant Rex Z-Metal is presented. Chain listings and prices are given, along with sprocket information. Take-ups, buckets, idlers, spray nozzles, and chain attachments are also listed. Chain Belt manufacturing and distribution facilities are described.

A copy can be obtained from Chain Belt Co., Dept. P. R., Milwaukee 1, Wis.

Centrifugal Blowers and Exhausters

Hoffman Multistage Centrifugal Blowers and Exhausters are described in Bulletin A-932 released by the U. S. Hoffman Machinery Corp., Air Appliance Div., 105 Fourth Ave., New York 3, N. Y., and can be obtained from the division. These blowers and exhausters are built for applications requiring air pressure from 1 to 9 psi or vacuum from 2 to 12 in. of mercury.

Typical performance curves are shown. The advantages of lower power-consumption, uniform pressure, variable volume, quiet operation, clean air delivery, and continuous-duty service are claimed for the blowers and exhausters. A list of data requested with inquiry concludes the bulletin.

Air-Cooled Engines

The Wisconsin Motor Corp., Milwaukee 43, Wis., has published a 64-page catalog of its air-cooled engines with over 260 photographs of the engines in use. The catalog begins with a set of photographs of the different basic styles of Wisconsin Air-Cooled Engines and follows with a description of the manufacture of the engines. A photograph of a 1914 Stutz Bearcat, powered by a Wisconsin engine, is included.

Detailed specifications, with the different sizes of each model, follow, together with power curves. Several pages of photographs of uses and applications appear for each style of engine, in agricultural, construction, industrial, material handling, oilfield, railroad, and specialized service.

KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Stainless Steel Wire

A new 20-page booklet of technical data on the application of stainless steel wire has been published by Allegheny Ludlum Steel Corp. Nearly all grades of Allegheny Metal are now available in wire form. Tables of physical properties, corrosion resistance, and analysis are included to help the reader in considering the various types. A discussion of the principal uses of stainless wire covers cold heading, weaving, heat-resisting belts, rope, spring wire, slide forming, welding, and winding.

Copies of the booklet are available on request from the trade by writing to Allegheny Ludlum Steel Corp., Advertising Dept., 2020 Oliver Bldg., Pittsburgh 22, Pa.

Continuous Feeder

Bulletin 5202, offered by Richardson Scale Co., Clifton, N. J., pictures and describes the Richardson constant-weight continuous feeder. The recently-designed belt feeder delivers a selected amount of product per minute to processing equipment in an uninterrupted flow. Typical products handled include cattle and poultry feeds, grains, limestone, and dry, free-flowing chemicals.

The bulletin lists specifications for the two models available, the 9-in. and the 18-in. (stream width) sizes. It describes the automatic regulating gate, special inlet opening, instruments, electrical equipment, and other basic parts and accessories.

A table lists the maximum capacities of the two models at various drive ratios and belt speeds. Photographs picture the drive mechanism, the scraper at the end of the feeder, and the weigh beam shown attached to the weighing rollers beneath the feed belt. A four-view engineering drawing is included, and dimensions are given for both models.

Instrumentation for Unattended Pumping Station

A six-page illustrated data sheet, released by The Foxboro Co., presents a detailed description of the new automatic system which controls the operation of unattended pumping stations for transmitting crude or product. Shown for the first time at the International Petroleum Exposition at Tulsa, the instrumentation, centralized in a single control cabinet, performs four major functions: control of the station on the line; start and stop control; station protection; and continuous recording of station performance.

When on the line, the station is governed by controllers which throttle the station discharge valve when suction pressure falls too low or station discharge pressure, power consumption, or line flow becomes excessive. Start and stop controls, responding to one of the four variables or to a remote signal, are relay-operated, with additional contacts providing emergency shutdown if equipment is endangered. Recording instruments log the history of station operations.

The publication devotes a separate section to each of the four phases of pipeline control, diagrams the instrumentation, and traces typical start and stop sequences. Copies of Application Engineering Data Sheet 781-3 will be sent on request from The Foxboro Co., Foxboro, Mass.

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NEW EQUIPMENT
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Titanium Machining

"Preliminary Machining Recommendations for Titanium" is the title of a booklet published by the Mallory-Sharon Titanium Corp., Niles, Ohio. The behavior of titanium and the company's recommendations are given for turning, milling, drilling, tapping, grinding (including internal grinding), reaming, abrasive-sawing, and hack-sawing processes. The booklet is 8 pages and is available, together with additional information, from the company.

Automatic Water Softener

Bulletin 612 describes the design and operation of an automatic water softener which is equipped with pilot-operated, diaphragm-type hydraulic valves. Time span and flow rate of each operating step is controlled independently to conform to specific operating requirements, type of zeolite used, size of equipment, and characteristics of water to be softened. The Double-Check design is claimed to provide up to 44 per cent more soft water and prevents costly loss of zeolite. Pilot-operated valves and self-contained control unit can be installed on existing water softeners to convert them to automatic operation, the manufacturer states. The bulletin may be obtained by writing on company letterhead to Elgin Softener Corp., Elgin, Ill.

Arc Weld Surfacing

The Lincoln Electric Co. has published a new edition of its Bulletin 466, "Lincoln Weldirectory for Hard Surfacing." The bulletin describes arc weld surfacing as the process of building up a layer of metal or a metal surface by electric arc welding. Five sections discuss the service required, service conditions, the part to be surfaced, dimensions, and the finish required.

The two-page Lincoln Hardsurfacing Guide, with instructions for use, is included. The different hard-surfacing electrodes with their properties and applications are given. Typical applications for each electrode are shown in photographs. A list of Lincoln electrodes and books and movies on arc welding conclude the bulletin. Copies will be sent on request by the Lincoln Electric Co., Cleveland 17, Ohio.

Gages and Pneumatic Controls

The Minneapolis-Honeywell Regulator Co., Industrial Div., has published two new catalogs.

Catalog 7001, 32 pages, describes many types of pressure and vacuum gages used to measure vacuums as great as 10^{-11} mm of mercury and pressures as high as 150,000 psi. The catalog covers indicators, recorders, pneumatic and electric controllers, and pneumatic transmission. The information is presented in tabular form.

Catalog 8950, 16 pages, describes, illustrates, and provides specifications for a variety of accessories for pneumatic control applications. Included are air pressure regulators, air filters, pneumatic relays, control by-pass panels, pneumatic switches, valve positioners, and other functional equipment. Data on control piping systems and the computing of air capacities are also included.

Both catalogs are available for the asking from Minneapolis-Honeywell Regulator Co., Station 64, Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa.

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Pipe Hangers

A 12-page bulletin describing the Counterpoise Pipe Hanger for high-temperature piping systems in steam-generating stations, refineries, and chemical plants has been released by the National Valve & Mfg. Co.

The bulletin describes how it is possible to to get accurate and efficient load-supporting effort of constant value throughout the entire range of travel as the pipe expands or contracts due to temperature changes.

Graphs for aid in selecting proper hangers, tables of dimensions, and erection and field-adjustment instructions are given along with illustrations of typical installations. Bulletin 153 can be obtained from the National Valve & Mfg. Co., 3134 Liberty Ave., Pittsburgh 1, Pa.

Controlled-Volume Pumps

Milton Roy Co.'s Bulletin 553 describes Milton Roy Motor-Driven Controlled-Volume Pumps. The 40-page bulletin contains information covering design and construction of these pumps. Other technical data includes capacity-pressure selection tables; types of capacity adjustments; and standard and special designs, as well as packaged systems. A two-page chart describes typical applications in six major industries. Also included is a four-page materials-selection chart in four colors.

Bulletin 553 is available from Milton Roy Co., Station "C," 1300 E. Mermaid Lane, Philadelphia 18, Pa.

Clutches and Transmissions

The Twin-Disc Clutch Co., Racine, Wis., has published a New Products Issue of its bulletin "Production Road." Several new Twin-Disc products are described and illustrated. They are a two-stage hydraulic torque converter, a disconnecting hydraulic power take-off (Model HUD), a two-speed transmission (Model T-302), an air-actuated clutch (Model PO), and an oil-actuated multiple-plate clutch.

Features of all these new products are given together with many applications. A two-page spread illustrating applications of Twin-Disc products is included.

Flexible Metal Hose

Bulletin No. 15-D on flexible metal hose has been issued by the Atlantic Metal Hose Co., Inc., 123 West 64th St., New York 23. It contains illustrations of the company's line of high-pressure interlocking bronze and steel flexible hose, tar and asphalt hose, loading and unloading, and necessary couplings. The bulletin lists all current applications and provides test and engineering data.

The company states Bulletin 15-D was designed to enable product designers, plant engineering and maintenance men, and purchasing agents to secure quickly information on the flexible metal hose best suited to their applications. Copies of Bulletin 15-D may be secured by writing to Mr. David M. Fuchs, Sales Mgr., at the company.

Socket Screws

The Standard Pressed Steel Co., Jenkintown, Pa., has brought out a four-page folder describing the advantages of the company's Unbrako socket screw products.

Included are socket-head cap screws, self-locking socket set screws, shoulder screws, flat-head socket cap screws, and button-head socket screws. Also in the folder are descriptions of socket screw keys, square-head set screws, pressure plugs, and dowel pins, all in the Unbrako line.

Requests for the folder should be addressed to Standard Pressed Steel Co., Box 558, Jenkintown, Pa.

Brick and Concrete Chimneys

The Consolidated Chimney Co. has published a booklet describing its brick and concrete chimneys and engineering services. Design data for radial brick chimneys with octagonal foundations, and chimneys for steam boilers, are listed in the bulletin.

Sample calculations, specifications for lightning protection, and a two-page discussion of design and construction specifications for both radial-brick and reinforced-concrete chimneys, and information required for chimneys complete the bulletin. Photographs of typical installations are included. Copies are available from the Consolidated Chimney Co., 8 South Dearborn St., Chicago 3, Ill., or 545 Fifth Ave., New York 17. N. Y.

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Oil-Tight Push-Button

The GE line of oil-tight push-buttons, with special emphasis on color-ring identification and building-block combinations, is described in a new two-color publication available from the General Electric Co., Schenectady 5, N. Y.

Designated as GEA-5779, the eight-page bulletin uses more than 35 photographs and drawings to illustrate the line's flexibility, its maintenance, and the various types of units and switches that are available. Also included are ratings and dimension diagrams

Cemented Carbides

Publication C-53 describes Kennametal Cemented Carbides, their characteristics, grades, and applications. The bulletin opens with a brief description of Kennametal and the procedure by which it is made. A table of physical properties and one of mechanical properties follows. These properties are then discussed at some length in following pages.

The different grade classifications of Kennametal are described, with the applications for which each is recommended by the manufacturer. Kentanium, Kennametal's titanium carbide compositions, is discussed, and its physical properties compared to those of Kennametal. A section on design applications and several pages of photographs of typical applications conclude the publication. Publication C-53 is available. Write Kennametal, Inc., Latrobe, Pa.

Lock Nuts and Lock Washers

Standard Locknuts and Lockwashers for ball and roller bearing applications are described in Bulletin No. 30, available from Standard Locknut and Lockwasher, Inc., 510 North Capitol Ave., Indianapolis 4, Ind. The bulletin contains detailed tables of Lockwasher dimensions, Locknut dimensions, and shaft dimensions. The following SAE numbers are listed: lock washers, W-00 to W-40; lock nuts, N-00 to AN-40; and shaft dimensions for N-00 to AN-40. Tolerances are included in the tables.

Barrell Finishing Compound

A 16-page manual on barrel finishing processes has been announced by Minnesota Mining and Mfg. Co., 900 Fauquier St., St. Paul, Minn. Use of the Honite barrel finishing method, a low-pressure, random honing process for deburring and burnishing small metal parts, is discussed in detail in the illustrated booklet.

Included are sections on how to choose proper size Honite and Super Honite barrel finishing chips for specific operations, and selection of the correct Honite barrel finishing compounds for each. Ten Honite barrel finishing compounds are described, together with the purpose, characteristics, metals for which they are recommended, and the prescribed mixture for each. The booklet is available upon request from the manufacturer.

Beta-Ray Gage

The use of a beta gage in controlling the weight of rubber coating applied to automobile tire cord and fabric is discussed in Vol. 1, No. 1, of "Nucleonics Views," published by Industrial Nucleonics Corp. The gage detects weight variations and adjusts for them and the process is recorded on a chart, all automatically.

Copies of "Nucleonics Views" will be sent on application to Industrial Nucleonics Corp., 1205 Chesapeake Ave., Columbus, Ohio.

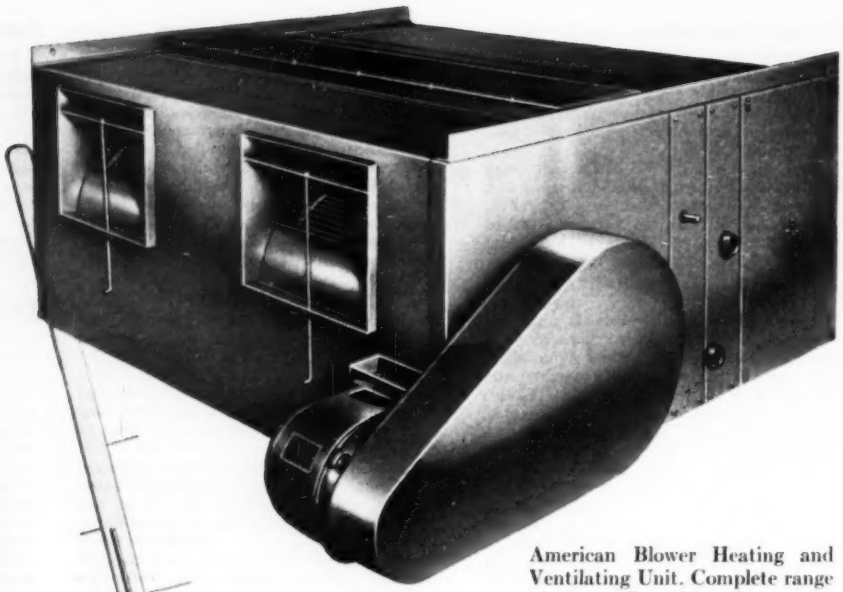
Cast Steel Valves

Edward Valves, Inc., has announced publication of a 56-page catalog covering their cast steel valves. Included is complete information on globe, angle, and check valves in 300-, 600-, 900-, and 1500-lb pressure classes. Parabolic disk valves for hand or motor control of volume are also described in detail.

In addition to the standard information on construction features, dimensions, weights, etc., the catalog contains complete information on material specifications, preparation of welding ends, flange facings, pressure-temperature ratings, and other technical data required for intelligent valve selection.

Copies of the catalog may be obtained by writing to Dept. CS, Edward Valves, Inc., 1200 West 145th St., East Chicago, Ind.

American Blower *Heating and Ventilating Units*



American Blower Heating and Ventilating Unit. Complete range of sizes. Capacities from 1000 to 33,000 cfm and 45,000 to 2,500,000 BTU/hr.

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These dependable units, with slow-speed centrifugal fans, are available in a wide range of sizes for wall, horizontal, inverted and floor installation. Each fan housing is equipped with Aileron control. Humidifiers, face and by-pass dampers, filter boxes and mixing boxes are available.

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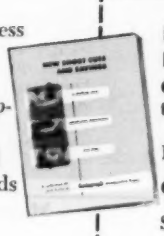

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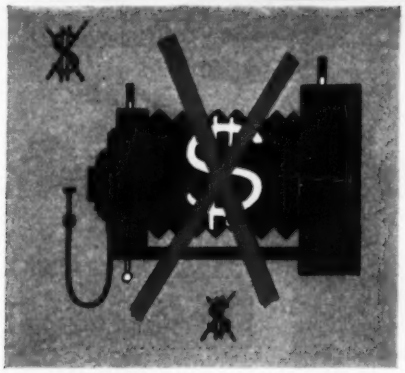

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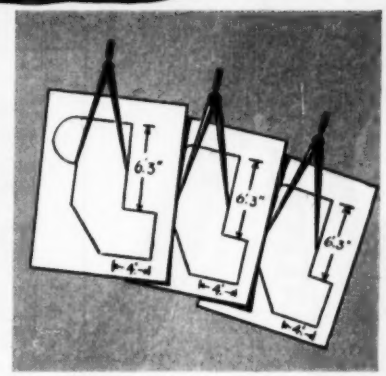

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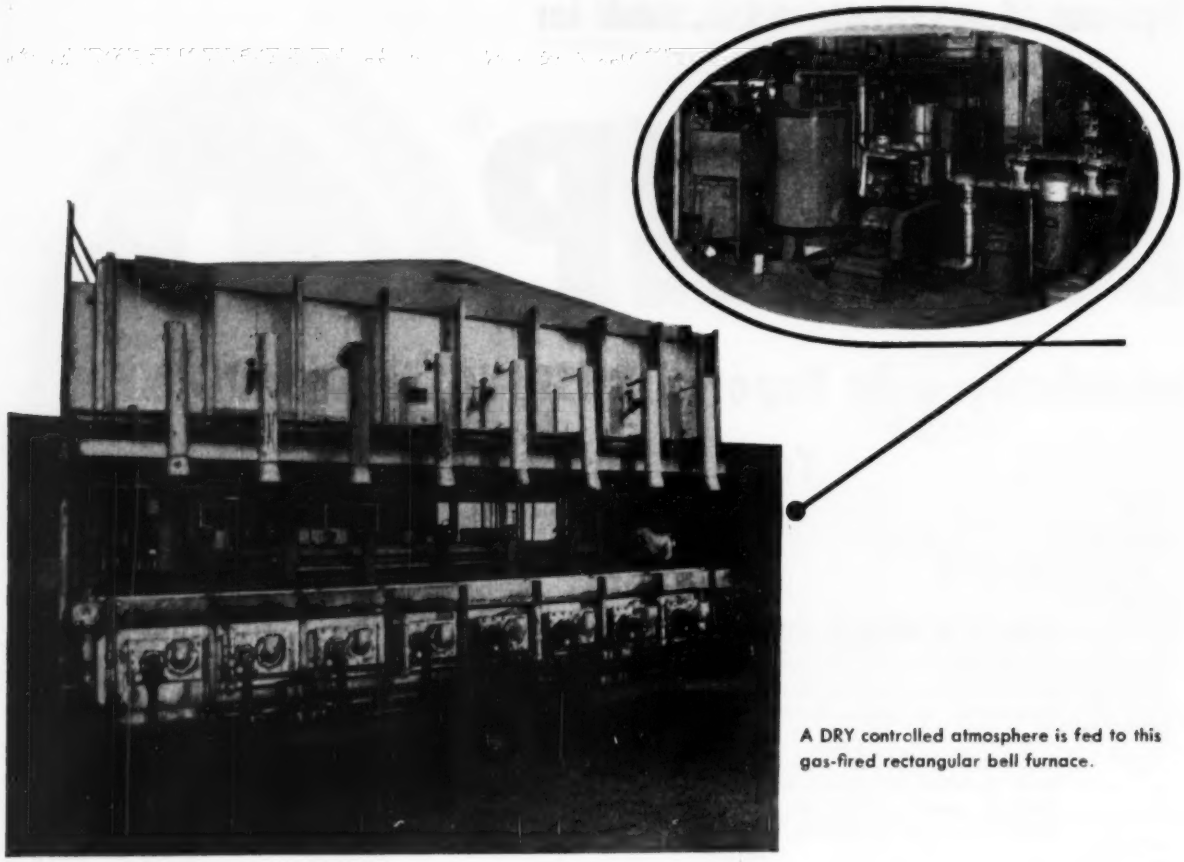

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In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege

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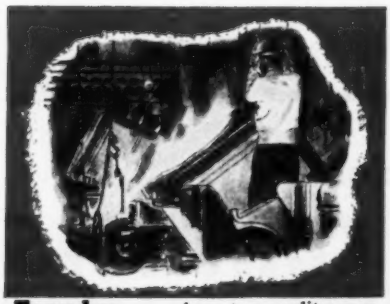

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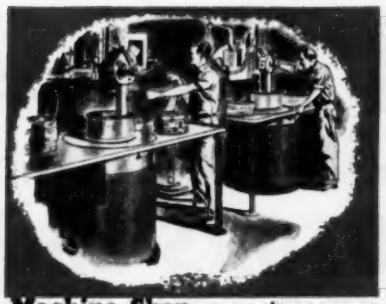

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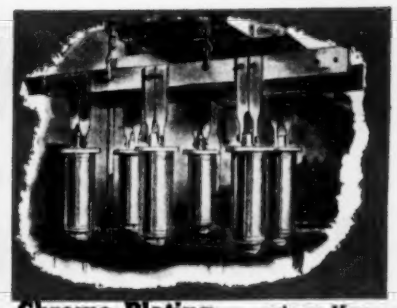
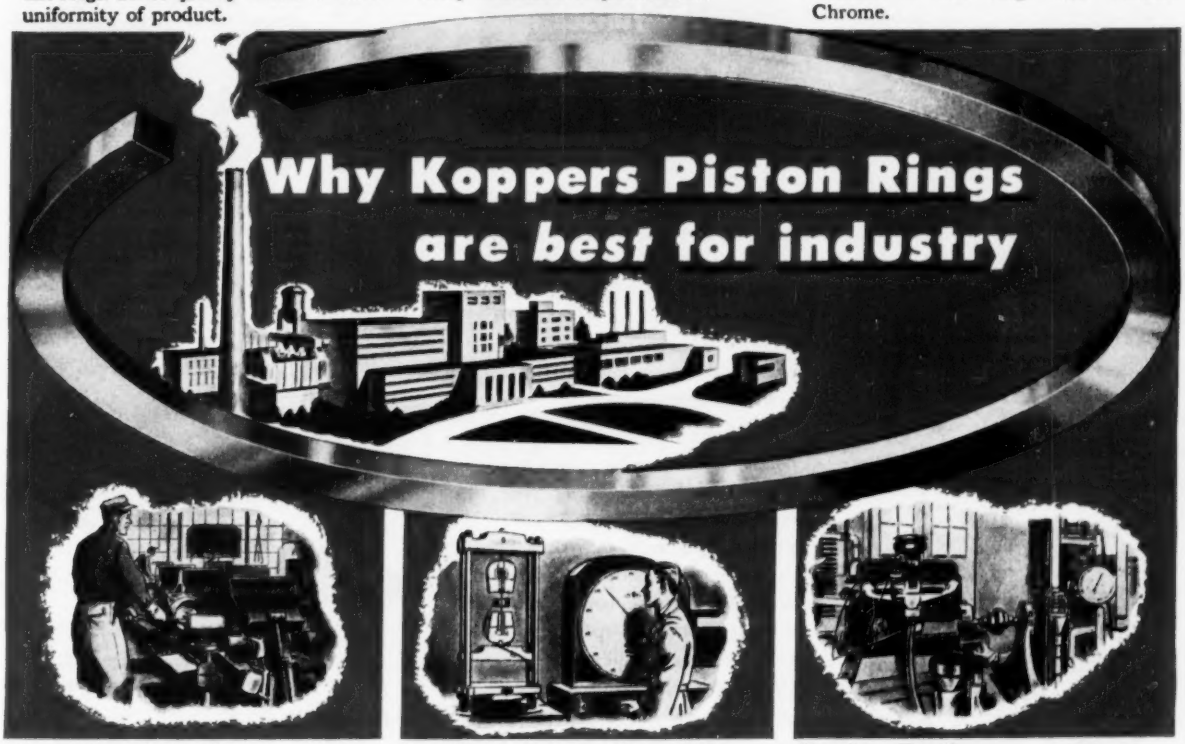


Chrome Plating . . . where Koppers uses the famous Van der Horst Process to coat rings with Porous Chrome.



Centrifugal Casting . . . an exclusive Koppers process that increases the strength of rings up to 4 times that of ordinary rings.

Engineering & Research . . . where constant testing, checking and experimenting result in better and better piston rings.

Engine Testing . . . where Koppers Rings are tested under far more severe conditions than they will ever be subjected to in ordinary use.

KOPPERS manufactures piston rings in every size, of every type, for every conceivable purpose. Koppers has the solution to every ring problem, whether in gasoline or diesel engines, compressors, hydraulic presses, steam locomotives or any other industrial or aircraft applications.

Koppers engineering, research and manufacturing facilities are responsible for recent important piston ring developments, K-Iron® and Porous Chrome*. K-Iron is a high-grade, closely-controlled material that imparts superior wear properties to piston rings and is surface treated chemically as an anti-scuffing aid.

Koppers Porous Chrome Rings hold and distribute oil during the break-in, quickly wear to best possible seating, *cut cylinder wear up to 50%, last up to 4 times as long as ordinary rings!*

** Van der Horst Process*

Write, wire or phone us for experienced help with your problems. Koppers Company, Inc., Piston Ring Dept., 1538 Hamburg St., Baltimore 3, Md.

KOPPERS®

Koppers American Hammered Industrial Piston Rings

Only **KOPPERS** *can furnish K-Spun® and Porous Chrome!*

DENISON HydrOILics

. . . for longer-lasting efficiency

PUMPS, MOTORS and CONTROLS

"The Finest Money Can Buy!"

Denison Axial Piston Pumps.
Hydraulically balanced, high-pressure, high-volume pumps in a range of sizes for circuits of 3000 and 5000 psi capacity . . . volume capacities 3.5 to 35 gpm. Constant volume, or variable volume with control by hand wheel, pressure compensation, stem, or cylinder. Face, flange or foot mountings. Catalogs P-4-1, P-4-2, P-4-3, P-4-10.

Multi-Range Flow Controls
permit full-scale regulation of flow for many different circuit needs, at pressures to 3000 psi. Infinitely adjustable within each range of control . . . cartridge-type single-spool design adjusts easily to various pump deliveries without changing spools. 2-port and 3-port types, with or without built-in check. ¼", ⅜" and ¾" sizes; 0 to 28 gpm capacities.

Pilot-Operated 4-Way Valves
—with solenoid control—for circuit pressures to 5000 psi. Eliminate spool-sticking during long high-pressure holding cycles. System pressure shifts valve spool; solenoid operates valving only. Catalog VD-1-1.

For more than 25 years, Denison has been meeting Industry's toughest demands for oil-hydraulic equipment—with efficient high-pressure components that have won wide approval for their rugged, compact design and long, low-cost performance.

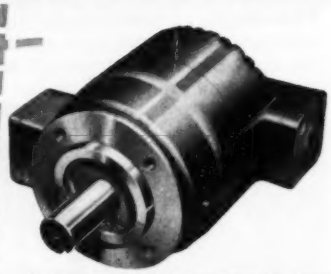
To meet constantly increasing needs, Denison now offers *today's most rapidly expanding line* of equipment for packaged hydraulic power, hydraulic transmissions, remotely controlled equipment, and other requirements for widely adjustable power, speed and control. A few of these HydrOILic components are shown here.

To make sure you get the fullest advantages of oil hydraulics—for variable-speed drives, accurate pressure control, spark-free power transmission, or closely controlled motion of any kind—specify Denison's HydrOILic Equipment.

Write for further details or call your Denison representative today.

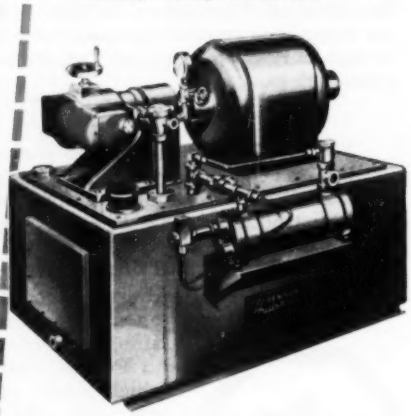
The DENISON Engineering Co.
1189 Dublin Rd., Columbus 16, Ohio

DENISON HydrOILics

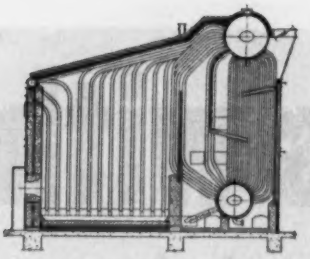


Vane-Type Single-Stage Pump/Motors,
built for continuous use at pressures to 2000 psi, are ready for either pump or fluid motor duty without alterations. Rotation of shaft can be either direction without internal adjustment. Four sizes, plus interchangeable cam rings, offer pumping capacities from 2½ to 70 gpm, or torque ratings from 13 to 257 inch-pounds per 100 psi. Catalog P-5.

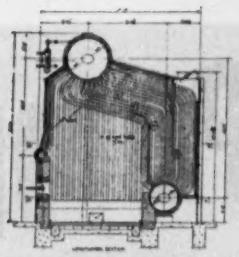
Denison Axial Piston Fluid Motors.
Four sizes, with torque capacities ranging from 510 to 5585 inch-pounds (about 24 to 160 HP). Speeds to 2000 and 3000 rpm. Compactly built . . . largest size is only about one foot in diameter. For circuits of 2500 and 5000 psi. Catalogs FM-2 and FM-3.



Denison's Self-Contained Pumping Units.
37 models cover any circuit need from 400 to 5000 psi and from 2 to 35 gpm requirements. Automatic water-cooled oil coolers or two-pass automatic heat exchangers available for extra heavy or continuous service. All operating components mounted on reservoir top in single-panel assembly, for easy removal as a unit. Catalogs PU3 and PU4.



2 Drum Water Tube Boiler



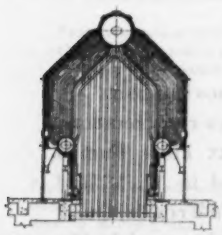
Type-S 2 Drum Boiler Series S1

FOR ALL INDUSTRY . . .

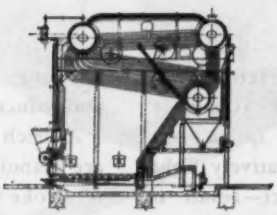
WICKES

STEAM GENERATORS

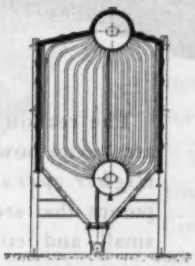
• In the oil, paper and chemical industries and in manufacturing plants, institutions and public buildings throughout the world Wickes Steam Generators are in constant daily service. All types, such as those illustrated on this page, with capacities up to 250,000 lbs. steam per hour and 1000 psi. Write for descriptive literature.



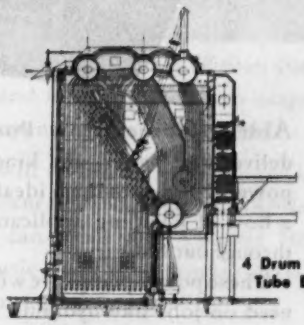
"A" Type Water Tube Boiler



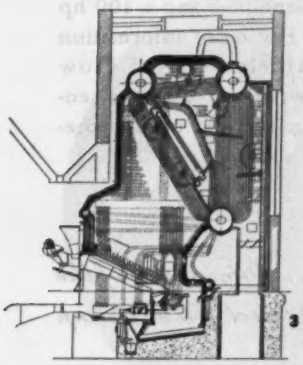
3 Drum Low Head Water Tube Boiler



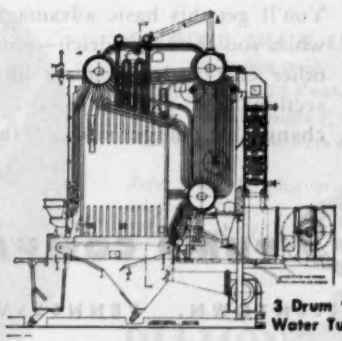
Wickes 2 Drum Waste Heat Installation



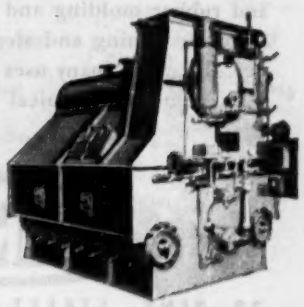
4 Drum Water Tube Boiler



3 Drum Water Tube Boiler



3 Drum "B" Type Water Tube Boiler

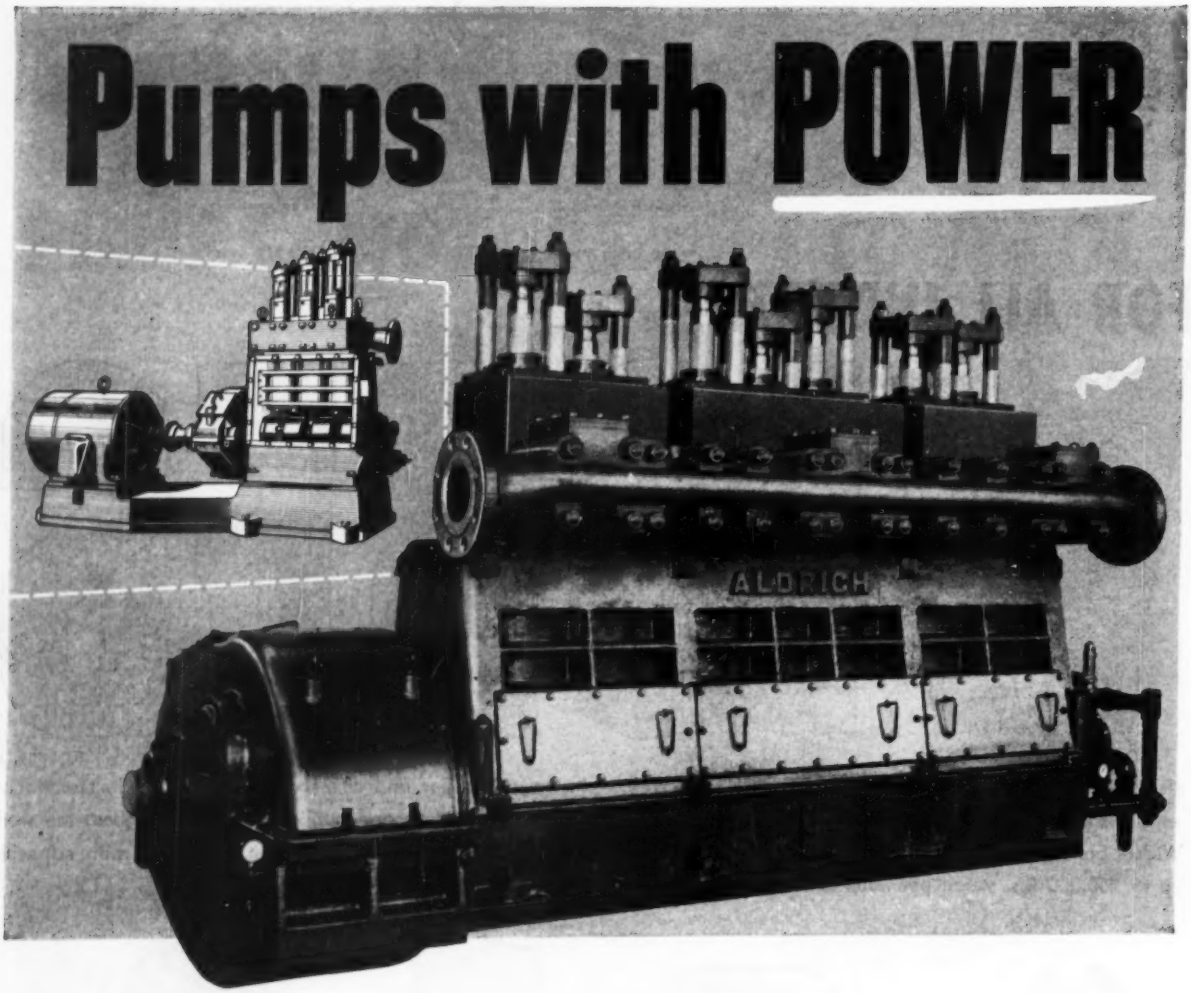


Type "A" "Packaged" Steam Generator

THE WICKES BOILER COMPANY • DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

RECOGNIZED QUALITY SINCE 1854 • SALES OFFICES: Atlanta • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Greensboro, N.C. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Pittsburgh • Portland, Ore. • Saginaw • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D.C.

Pumps with POWER



Aldrich Direct Flow Pumps deliver real *power*—the kind of power that makes them ideal for a host of pumping applications throughout industry.

These power pumps are widely used on jobs like hydraulic systems for press operation; plastic and rubber molding and extrusion; die casting and steel mill descaling, and many uses in the petroleum and chemical industries.

The reason Aldrich Pumps are "extra-powered" is simple. *Higher operating speeds*—in pumps that are relatively light, small and compact—result in greater *pressures* and *volumes.*

Added power like this means more *work* from lower cost units. You'll get this basic advantage when you choose Aldrich—plus other cost-cutting features like sectionalized fluid ends . . . changeable plunger sizes . . . interchangeable moving parts . . . and reduced space requirements.

Aldrich Direct Flow Pumps are manufactured in 3″, 5″ and 6″ stroke sizes, in Triplex, Quintuplex or Septuplex models (50 to 900 hp). Pictured here are a 700 hp Septuplex and a 100 hp Triplex. For more information about Aldrich Direct Flow Pumps write for catalogs, engineering service, or a representative's call.

THE ALDRICH PUMP COMPANY

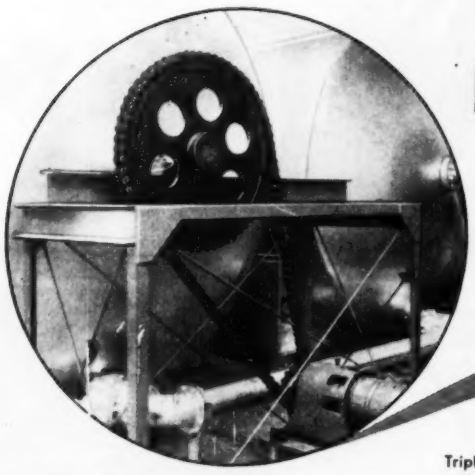
29 PINE STREET • ALLENTOWN, PENNSYLVANIA

. . . Originators of the Direct Flow Pump

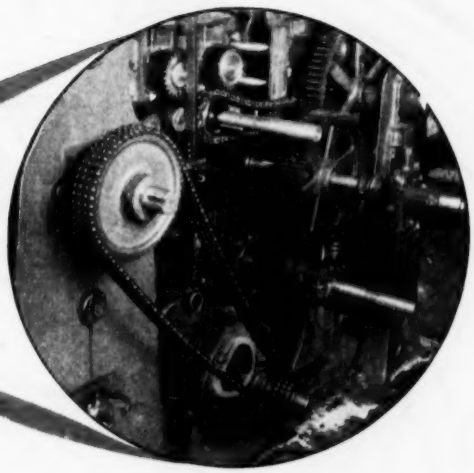
Representatives: Birmingham • Bolivar, N. Y. • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit Duluth • Houston • Jacksonville • Los Angeles • New York • Omaha • Philadelphia • Pittsburgh • Portland, Ore. Richmond, Va. • St. Louis • San Francisco • Seattle • Spokane, Wash. • Syracuse • Tulsa

In your plant, too

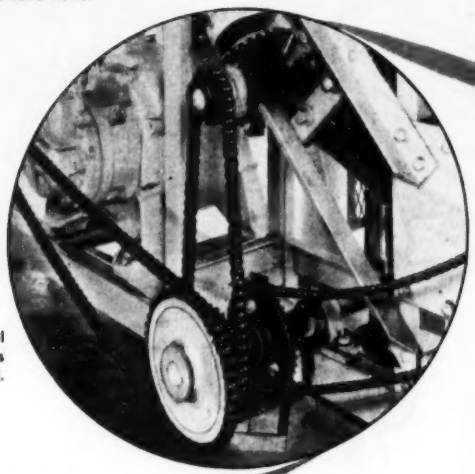
there are many jobs DIAMOND ROLLER CHAINS can do most effectively



Agitator drive 5-ft. center distances. Exact slow speed of agitator assured. (Guard removed to show No. 478 Diamond Roller Chain).

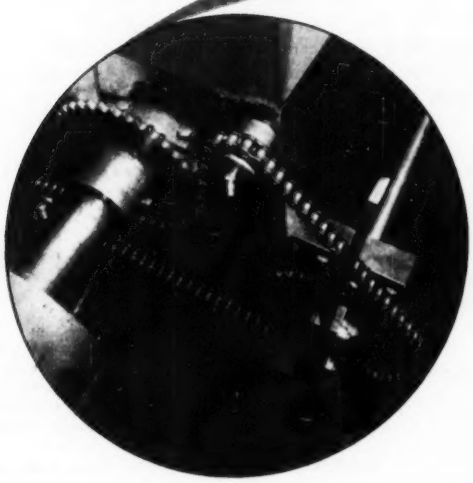


Triple strand chain from motor with another shaft to shaft drive above.



Power source to several shafts at speeds selected as required.

Plant drive in wire mill—driven shaft above is rotated in opposite direction to driving shaft (below).



• For high speed drives from motors, drives from shaft to shaft or one shaft to several others, Diamond Roller Chains provide ideal operation. They are non-slipping, highly efficient (98-99%) and insure reliable top output for many, many years of service.

You will find many applications in your plant where Diamond Roller Chains can serve you. Catalog 709 gives basic chain and sprocket data—copy on request.

DIAMOND CHAIN COMPANY, Inc.
Where High Quality is Tradition
Dept. 413, 402 Kentucky Avenue
Indianapolis 7, Indiana
Offices and Distributors in All Principal Cities

Refer to the classified section of your local telephone directory under the heading CHAINS or CHAINS-ROLLER

Shot-Peening Since 1944

Diamond Chain has long recognized that certain types of internal stressing of chain parts would increase fatigue resistance. To this end, link plates have been specially processed and chain rollers and other parts have been shot-peened since 1944.

DIAMOND  **ROLLER CHAINS**

Are You

The chain habit is a good one to have when you're designing drives and conveyors. But *don't* be "chained" to just one particular type of chain. In the complete Chain Belt line there are literally hundreds of sizes and types of chain, each one designed to do a specific kind of work. Naturally, you want to select the chain that will perform most efficiently and economically over the longest period of time.

There's where your Chain Belt Field Sales Engineer can help you. You see, he is specially trained to study with you your chain selection problems. He can recommend from the complete Chain Belt line the one chain which will give the most satisfactory service in your

REX

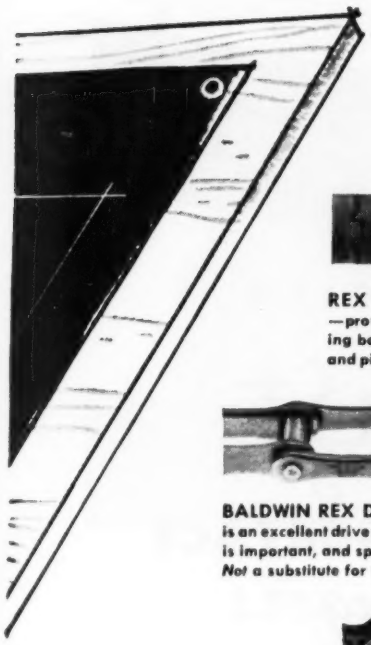
BALDWIN REX®

Chain

ATLANTA • BIRMINGHAM • BOSTON • BUFFALO
CHICAGO • CINCINNATI • CLEVELAND • DALLAS
DENVER • DETROIT • EL PASO • HOUSTON
INDIANAPOLIS • JACKSONVILLE • KANSAS CITY
LOS ANGELES • LOUISVILLE

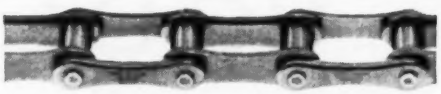
Distributors in Principal Cities in the United States and abroad

"CHAINED" By Habit?



REX® CAST PINTLE CHAIN—for slower speed drive and conveyer service where long life due to greater bearing area is needed.

REX TABLETOP® CONVEYOR CHAIN—provides a smooth, steady surface for conveying bottles, jars, cans, etc. Simple, two-piece link and pin construction makes for easy maintenance.



BALDWIN REX DOUBLE PITCH ROLLER CHAIN is an excellent drive or conveyor chain where light weight is important, and speeds and loads are low to moderate. *Not* a substitute for standard roller chain.

BALDWIN REX® STANDARD ROLLER CHAIN—ideal for high speed drives and timing applications. A wide range of attachments is available for every type of conveyor service.

BALDWIN REX LEAF CHAIN—an excellent chain for tension linkage applications where linear movement of the chain is not continuous in direction. Used on lift trucks, hoists, controls, etc.

REX CHABELCO® STEEL CHAIN—especially suited for operation where loads are heavy and conditions of dust, dirt, and grit are encountered. This chain can really take it!

application. Illustrated here are just a few samples from our complete line. They are all quality chains built with over 60 years of chain-making experience behind them.

Next time you have a chain selection problem, why not call your nearest Chain Belt branch office; or if you prefer, just mail the coupon. Chain Belt Company, 4765 W. Greenfield Ave., Milwaukee 1, Wis.

Belt COMPANY
OF MILWAUKEE

MIDLAND, TEXAS • MILWAUKEE • MINNEAPOLIS
NEW YORK • PHILADELPHIA • PITTSBURGH
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Export Offices: 4800 W. Mitchell St., Milwaukee 1, and 19 Rector St., New York City

Chain Belt Company, 4765 W. Greenfield Avenue 52-104
Milwaukee 1, Wis.
Gentlemen:
I am particularly interested in chains for the following purposes:
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Please send me appropriate literature.
Name.....
Address.....
City.....*State*.....

Keep Heat Transfer Surfaces CLEAN...

SPECIFY Vogt

SCRAPED SURFACE *Exchangers*

IF you are all "gummed up" with a tough heat transfer problem, Vogt Scraped Surface Exchangers will provide the answer. They have patented scraper elements which prevent fouling of the heat transfer surfaces and insure the highest rate of heat exchange between the product and the cooling or heating medium. The scrapers also continuously agitate the fluid and assist removal of solids from the unit.

DOUBLE PIPE EQUIPMENT is available in two types; EXCHANGERS, for cooling with water, brine, and cold filtrate, and for heating with steam or hot liquids; and CHILLERS, for use with volatile refrigerants such as ammonia, propane, and Freon. Both types have 8" jacket pipes and 6" inner pipes with scrapers.

SHELL AND PIPE TYPE UNITS are designed for use with volatile refrigerants and for heating fluids with steam or similar heating mediums. They consist of large welded shells each containing seven 6" scraped pipe sections.

Vogt Scraped Surface Exchangers serve profitably as oil chillers, crystallizers, and heaters in many processes in the petroleum and chemical industries. Their application to your heat transfer problems will receive the prompt attention of our Engineering staff.

Write for Bulletin PE-1

*DOUBLE PIPE UNIT. Drive end close-up of 12 section unit under test in our shop.

*SHELL and PIPE UNITS. Two of five units installed in a leading petroleum refinery.

*Patented

HENRY VOGT MACHINE CO.

LOUISVILLE 10, KENTUCKY

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READY FOR RUGGED DUTY

Maxi-Power Drive assembly for overseas cement mill. This unit, on a special base, has long input and output shafts supported by outboard bearings. The large spur pinion will drive a 20-foot, 18-inch face spur gear.

FOOTE BROS. MAXI-POWER DRIVES

With maximum load-carrying capacity for day-after-day service, Foote Bros. Maxi-Power Drives offer a ready solution for toughest speed reduction applications.

Sturdy, compact Maxi-Power Drives have precision-generated helical gearing — uniform load distribution across the entire tooth surface. Maximum performance is assured for all applications where rugged service is required.

These parallel shaft speed reducers are available in single, double or triple reductions. Ratios range up to 360 to 1 — capacities up to 1,550 horsepower — ideal for slow-speed requirements.

Foote Bros. also offers a complete line of foot or flange mounted drives for both horizontal and vertical applications, and Foote Bros.-Louis Allis Gearmotors, horizontal and vertical.

FOOTE BROS. Duti-Rated LIFETIME GEARING

This Trademark Stands for the Finest in Industrial Gearing

Line-O-Power Drives

Foote Bros.-Louis Allis Gearmotors

Hygrade Drives

FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR AND MACHINE CORPORATION
Dept. Q, 4545 South Western Boulevard, Chicago 9, Illinois
Please send Bulletin MPB containing full information on Foote Bros. Maxi-Power Drives.

Name.....

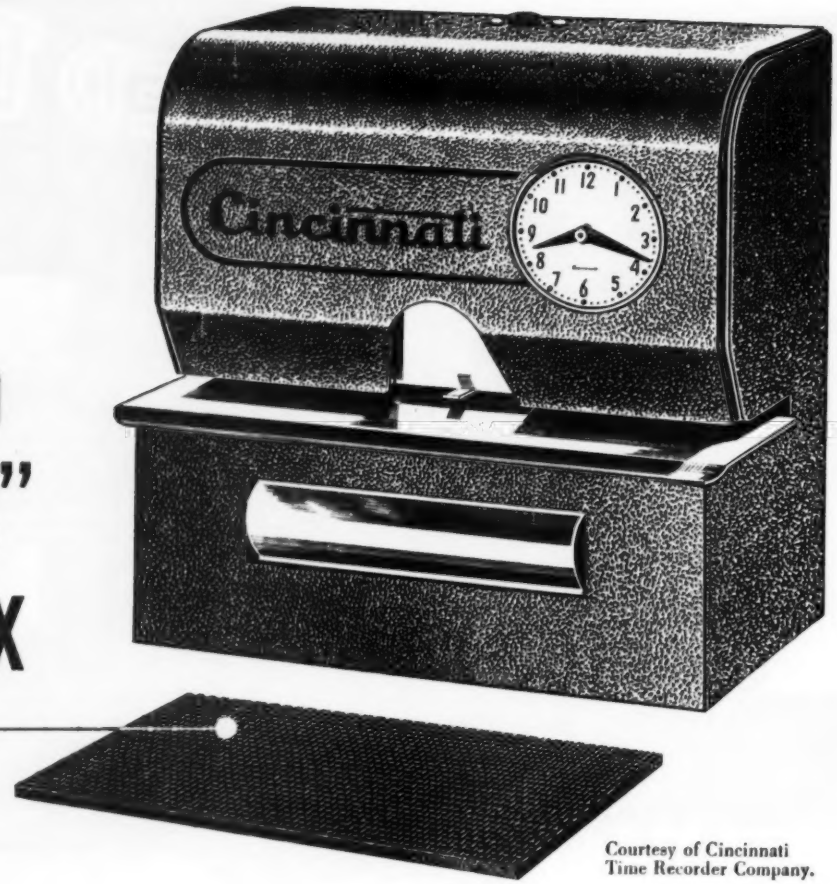
Company.....

Address.....

City.....Zone.....State.....

Ends "vibration crawling" SPONGEX

Cellular Rubber



Courtesy of Cincinnati Time Recorder Company.

Vibrations caused this time recorder to crawl on smooth surfaces. To end this annoyance, The Cincinnati Time Recorder Company uses an inexpensive base pad cut from a sheet of Spongex cellular rubber. This pad firmly holds the recorder and avoids the inconvenience of permanent installation of the machine.

Similar Spongex pads are equally effective in eliminating "vibration crawling" on other types of portable machines, such as electric fans, paint sprayers and movie projectors. In each case, this inexpensive extra increases efficiency and ends annoyances for customers.

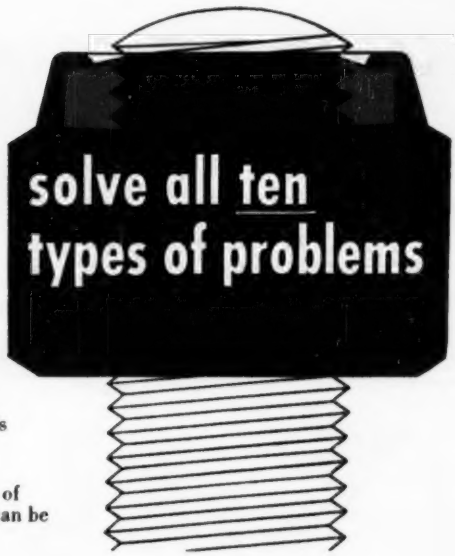
Perhaps *your* customers would appreciate the "hold-ability" of Spongex pads. Write today for further information on the applications of Spongex cellular rubber sheet stock to portable machines.

SPONGEX® Cellular Rubber

for cushioning, insulating, shock absorption, sound and vibration damping, gasketing, sealing, weatherstripping and dust proofing.

THE SPONGE RUBBER PRODUCTS COMPANY 601 Derby Place, Shelton, Conn.

elastic stop nuts solve all ten types of problems

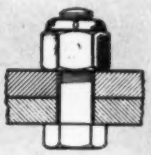


Here are ten typical fastening problems. One device, the ELASTIC STOP nut, solves them all—without additional parts or operations. Deliberately undersized in relation to bolt diameter, the red elastic collar grips the bolt with a perfect fit, exerting a continuing self-locking pressure against the threads, and holding the nut securely in place at any point on the bolt. It also provides a tight seal against the bolt threads, which prevents seepage and wear-producing axial play. And because the bolt threads are protected against moisture from without, the nuts are not "frozen" to the bolt by corrosion.

ELASTIC STOP nuts stay tight, right where you put them, in spite of vibration and stress reversals. Yet they are not jammed in place, and can be removed with a wrench and reused many times.

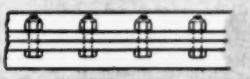
For further information on ESNA self-locking fasteners, mail the coupon below.

TIGHTENED AGAINST THE WORK



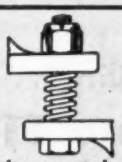
Wherever a vibration or impact proof bolted connection is desired.

On all electrical terminals subjected to vibration in transit or operation.

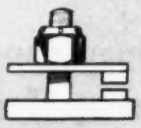


For uniform and precise prestressing of multiple bolt assemblies . . . adjusted by predetermined wrench torques.

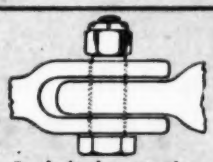
LOCATED ANYWHERE ON THE BOLT



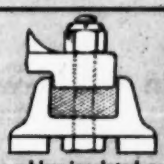
Spring-mounted connections or dynamic balancing, where nut must stay put yet be easily adjusted.



On make-and-break adjustment studs where accurate contact gaps are required.

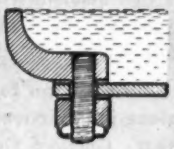


For bolted connections requiring predetermined play.

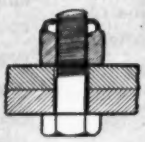


For rubber-insulated and cushion mountings where the nut must not work up or down.

FOR MANY SPECIAL APPLICATIONS



To seal bolt threads where elimination of leakage past stud threads is necessary.



To seal bolt threads where it is necessary to protect them from corroding elements.

To obtain delicate adjustments for applications such as bearing locknuts where precise adjustment is essential.

ELASTIC STOP NUT CORPORATION OF AMERICA

Dept. N40-811, Elastic Stop Nut Corporation of America
2330 Vauxhall Road, Union, New Jersey

Please send the following free fastening information

☐ Elastic Stop nut bulletin ☐ Here is a drawing of our product. What self-locking fastener would you suggest?

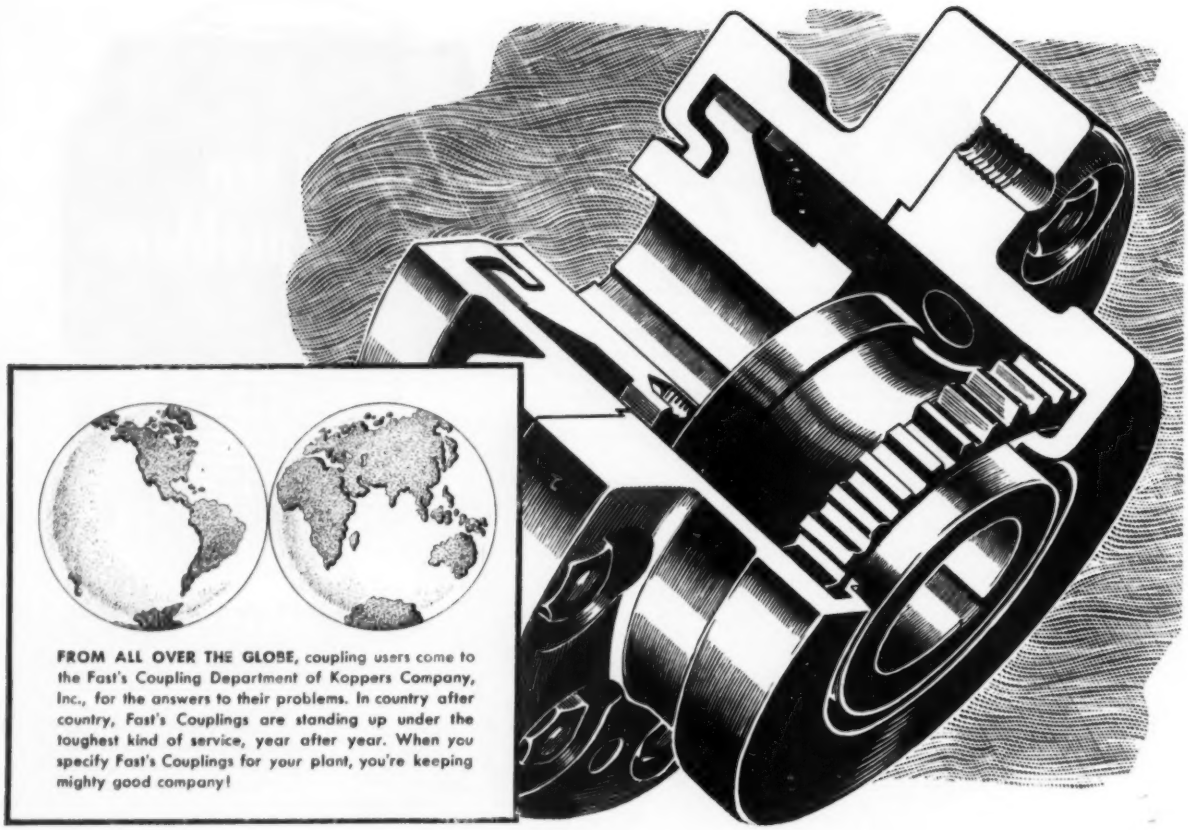
☐ Rollpin bulletin

Name _____ Title _____

Firm _____

Street _____

City _____ Zone _____ State _____



FROM ALL OVER THE GLOBE, coupling users come to the Fast's Coupling Department of Koppers Company, Inc., for the answers to their problems. In country after country, Fast's Couplings are standing up under the toughest kind of service, year after year. When you specify Fast's Couplings for your plant, you're keeping mighty good company!

In world-wide reputation for rugged dependability . . .

FAST'S Couplings are FIRST!

Fast's Couplings are still first choice the world over . . . with their number pushing the three-quarter million mark!

Whatever your coupling applications, this reputation is your guarantee of proved protection against costly shutdowns! Fast's Couplings give you *rugged construction* . . . because their original design has been maintained without basic change or sacrifice in size or materials. Fast's Couplings give you *lowest cost per year* . . . because they usually outlast the equipment they connect. And Fast's Couplings give you the benefit of Koppers *free* engineering service . . . assuring you of the right coupling for any job and the right solutions to tough coupling problems.

Write today for full details on Fast's Couplings and Koppers Engineering Service to: KOPPERS COMPANY, INC., *Fast's Coupling Dept.,* 258 Scott Street., Baltimore 3, Maryland.

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FAST'S Couplings

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • BALTIMORE, MD. This Koppers Division also supplies industry with American Hammered Industrial Piston and Sealing Rings, Koppers-Elex Electrostatic Precipitators, Aeromaster Fans and Gas Apparatus.

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KOPPERS COMPANY, INC., *Fast's Coupling Dept.,* **258 Scott St., Baltimore 3, Md.**

Gentlemen: Send me a Fast's Catalog giving detailed descriptions, engineering drawings, capacity tables and photographs.

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Address .....

City ..... **Zone** ..... **State** .....

Where weight and space are critical

New miniature transducers expand the scope of dynamic recording systems

A BASIC PROBLEM in transducer design is reduction of size to a point where characteristics of the device under test are not affected. Two new transducers developed by Consolidated combine unusually small size and weight with operating characteristics fully comparable to previous larger instruments.

The 4-310 Pressure Pickup features a direct-sensing diaphragm and is mountable flush with any surface to avoid both volume changes in the pressure chamber and spurious turbulence patterns. It is valuable for aerodynamic pressure surveys and other high-frequency liquid or gaseous pressure measurements.

The new 4-118 Velocity Pickup is usable at high temperatures in any plane of orientation. Its output equals instruments many times its size and weight, yet it has no loading effect on structures being tested. Applications include turbine, supercharger, rocket and jet engine vibration studies.

4-310 pressure pickup

Sensitivity: 4 mv/v of applied excitation.

Ranges: 5, 15, 50, 150 psi.

Temperature range: —100°F to +250°F.

Sensitive element: 350-ohm, 4-arm resistance bridge.

Excitation: ac or dc.

Linearity and hysteresis: excellent characteristics.

Acceleration response, zero and sensitivity drift: negligible.

Versatility: usable for liquid or gas measurements.

Size: diaphragm diameter ½", length ⅝".

Complete specifications in Bulletin 1534A-X1.

4-118 velocity pickup

Output: 100 mv/in./sec. @ 250 cps.

Frequency range: linear ±10% from 50 to 500 cps over range of —65°F to +500°F.

Amplitude limits: to 0.12" peak-to-peak.

Transverse sensitivity: negligible.

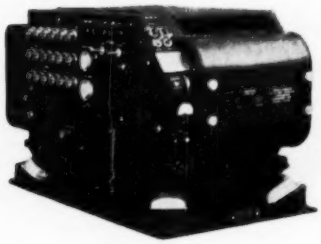
Sensitive element: self-generating, nominal 700-ohm dc coil resistance.

Total weight: 1.3 ounces.

Size: ¾" diameter, height 1".

Complete description and specifications in Bulletin 1535-X1.

Vibration can be easily, precisely measured and monitored by combining the Velocity Pickup with Consolidated's Vibration Meters, described in Bulletin 1505B.



Transient or high-frequency vibrations and pressure changes can be recorded for detailed study with Consolidated's Recording Oscillographs. Send for Bulletin 1500B.

Consolidated Engineering
CORPORATION
300 North Sierra Madre Villa, Pasadena 15, California
Sales and Service through **CEC INSTRUMENTS, INC.,** *a subsidiary with offices in: Pasadena, New York, Chicago, Washington, D. C., Philadelphia, Dallas.*

analytical instruments for science and industry

Miniature transducers

Consolidated's new miniature transducers, among the smallest ever designed for pressure and vibration measurement, are adaptable to the most exacting mounting requirements.

Double Assurance..

WHEN YOU SPECIFY Pacific

PRECISION BUILT PUMPS

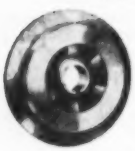
The requirements for your specific service having been made known by your engineering specifications you will look carefully into the benefits offered by the various bidders. After looking, it's dollars to doughnuts your requisition will specify *"Pumps by Pacific"* because of the greater benefits of Pacific's *double assurance.*

Assurance that Pacific's design, workmanship and materials will fit the requirements of your specific service.

Assurance that Pacific's dependable fast service will fit your needs.

Whether shipped by Air...Rail or Motor Freight...

Pacific Pumps and parts will be on the job early



Order recieved November 2 for 2 chrome steel impellers with heat-treated and hardened wearing rings—Parts shipped November 6

Order received 10:30 a.m. Wednesday for a Pacific multi-stage rotor—Rotor shipped 8 a.m. Friday, 46½ hours later

CP-8

PACIFIC *Precision Built* **PUMPS**

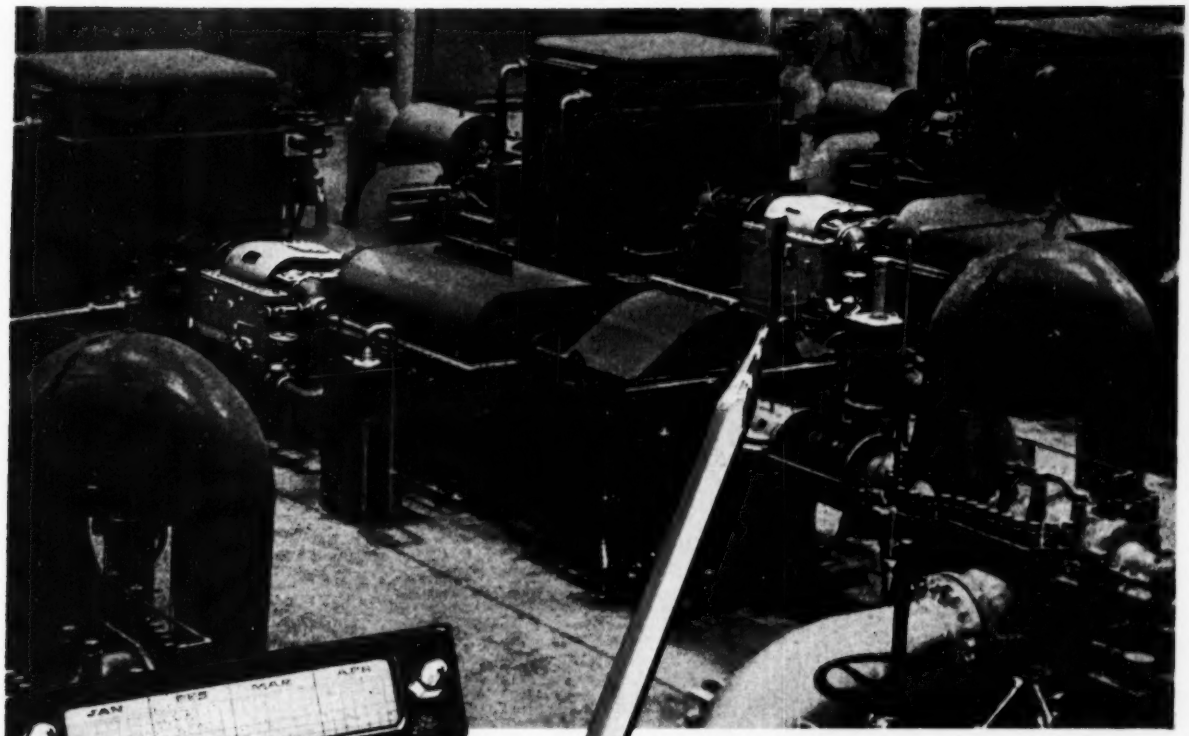
Pacific Pumps inc.

ONE OF THE DRESSER INDUSTRIES

HUNTINGTON PARK, CALIFORNIA

Export Office: Chanin Bldg., 122 E. 42nd St., New York

Offices in All Principal Cities



Pacific-Western high speed units find application in many industries, including the one pictured above, taken at the Hanford plutonium manufacturing plant. The Hanford Works is operated by the General Electric Company for the Atomic Energy Commission.

MEMO: To Engineers
FROM: Western Gear Works

Pacific-Western High Speed Units are Perfect from "A" to "Z" (atomic energy)

Your problem may not involve Atomic Energy, but whatever it is, if it calls for a step up in speed between prime mover and driven equipment, you can be sure there is a Pacific-Western High Speed Unit "just right" for your needs. A full range of ratios and horsepowers in standard as well as special designs will meet your needs. Our engineers will be glad to assist you in your selection without charge or obligation. Western Gear Service is a *complete service*. Call us now for further information.

Bulletin 5204 H. S. is yours for the asking. Complete coupon below.

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Executive Offices, Post Office Box 182, Lynwood, California.
Please Send Bulletin 5204 H. S.

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5328

Write, wire or phone your nearest Pacific-Western office

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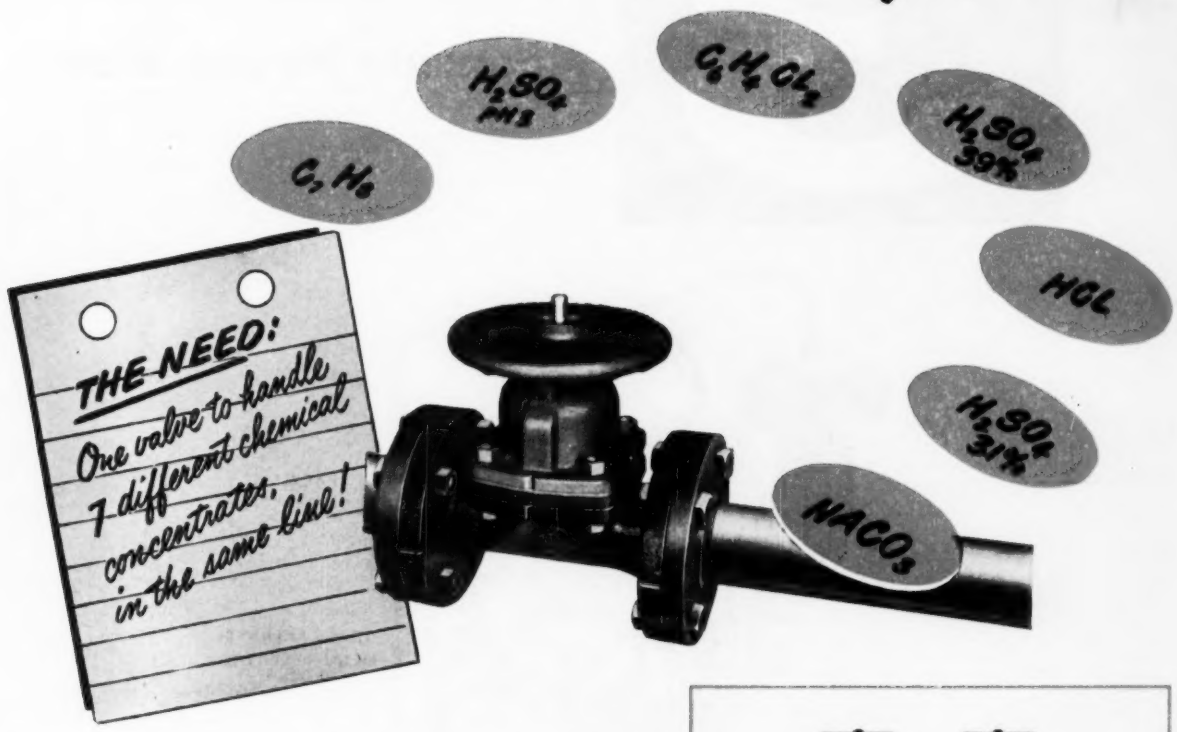
2600 E. Imperial Highway, Lynwood (Los Angeles County), California
1035 Folsom St., San Francisco 3, California
Belmont (San Francisco Peninsula), California
132-134 W. Colorado St., Pasadena 1, California
1117 N. Palmer St., Houston 3, Texas

Representatives — N. 2605 Division St., Spokane, Washington
930 S. E. Oak St., Portland 14, Oregon
Room 212, Ross Bldg., Denver 2, Colorado
500 South Ervay Street, Dallas, Texas
Engineering & Machinery Ltd., 1366 W. Broadway, Vancouver, B. C.

WESTERN GEAR WORKS
Manufacturers of PACIFIC-WESTERN Gear Products
Pacific Gear & Tool Works

Plants: Seattle
San Francisco
Belmont (S. F. Peninsula)
Lynwood (Los Angeles County)
Pasadena
Houston

TROUBLE multiplied by 7



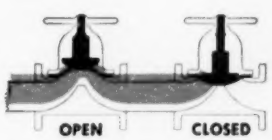
A manufacturer was looking for *one valve* which would handle *seven chemicals* of varying temperatures and concentrations, one after another, in the same line. They were . . .

SODIUM CARBONATE	PH 9	90°C
HYDROCHLORIC ACID	8%	100°C
SULPHURIC ACID	PH 3	20°C
SULPHURIC ACID	39%	42°C
SULPHURIC ACID	31%	15-20°C
TOLUENE	*(Full strength but associated with traces of other chemicals)*	

ORTHODICHLOROBENZENE — **Cleaning Solvent**

Valves suitable for use with these chemicals individually were available. But only *one valve* was found which could handle them in combination. It was the Grinnell-Saunders Diaphragm Valve, glass lined, with chemically inert KEL-F Diaphragm. The Grinnell KEL-F diaphragm not only prevented the liquid from attacking working parts, but it eliminated leakage around the stem.

Piping in today's complex industrial plants is an exacting science involving the handling of highly corrosive fluids, gases, compressed air, beverages, foods and suspended solids . . . in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors. Under such conditions, the amazing adaptability of the Grinnell-Saunders Diaphragm Valve explains its acceptance by industry after industry. For further details, write for Grinnell-Saunders Diaphragm Valve Catalog.



Features which have made Grinnell-Saunders Diaphragm Valves the specified valve in many different industries:

Streamlined flow. Smooth, streamlined passage, without pockets. Frictional resistance at a minimum.

Leak-tight closure against grit, scale, suspended solids.

Working parts absolutely isolated from fluid. Diaphragm completely seals off working parts from fluid in the line.

Body, lining and diaphragm materials to meet service condition. Bodies stocked in cast iron, malleable iron, stainless steel, bronze and aluminum; other materials on special orders. Valve bodies lined with lead, glass, natural rubber or neoprene. Diaphragm materials of natural rubber or synthetics.

Minimum maintenance. No refacing or reseating is required. No packing glands to demand attention. New diaphragm can be inserted without removing valve body from the line.

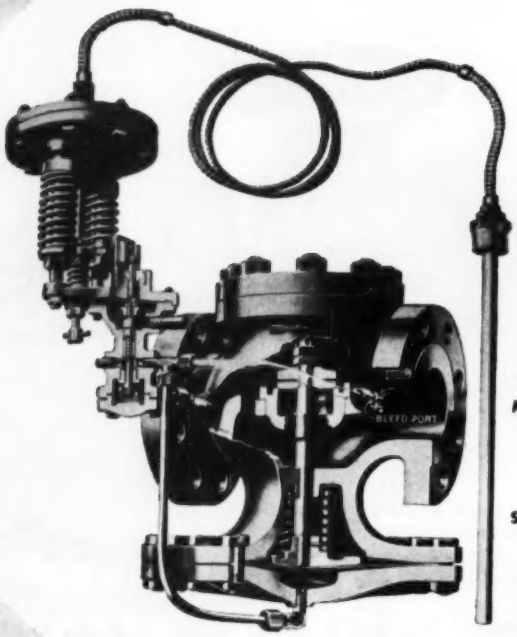
GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

3 Reasons for Accurate Regulation



PACKLESS CONSTRUCTION

LARGE BALANCED METAL DIAPHRAGM

SENSITIVE PILOT

Spence

Packless construction eliminates the need for closely fitted parts that may stick or bind due to dirt or uneven expansion of the parts.

In Spence Temperature Regulators, the Main Valve is actuated by a large balanced metal diaphragm which responds to the slightest changes in temperature.

Sensitive Pilots are designed to limit heater pressure to an adjustable maximum. As the temperature at the thermostat drops a few degrees there is a corresponding increase in steam pressure up to the limit for which the Pilot is set.

With regulators that respond only to temperature, an increase in load is accompanied by a momentary decrease in steam pressure caused by faster condensation in the heating element. There is a time lag until the thermostat senses the temperature drop and opens the valve wider. Spence Temperature Regulators act like pilot operated pressure regulators when this occurs. They respond instantly to maintain the steam pressure until the thermostat has a chance to further increase it as needed for the heavier load.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year, without requiring extensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.

9E120

SPENCE ENGINEERING COMPANY, INC., Walden, New York

Engineers' Reference Books

Published by
The American Society of Mechanical Engineers

MANUAL ON THE CUTTING OF METALS

Published January 1953. $10.00—This new Manual goes far beyond the fundamental study of the 1939 edition in scope and detail treatment. It covers types, uses, and preparation of single-point tools; mechanical characteristics and structure of work material; cutting fluids; machining of various metals; forces, power, and cutting speeds for specific cutting conditions when turning a wide variety of metals; and economics of metal cutting. Tabular data on cutting speeds and horsepower for various feeds and depths of cut when turning steel and cast-iron are also given.

PROCEEDINGS OF THE FIRST U. S. NATIONAL CONGRESS OF APPLIED MECHANICS

Published January 1953. $20.00—This book provides a compendium of recent advances made in connection with many of the most significant problems encountered throughout modern applied mechanics. Of its 130 contributions, 28 are concerned with dynamics, vibrations, impact, and general methods; 34 cover elasticity, photoelasticity, plate theory, and elastic instability; 27 deal with plasticity, materials behavior and failure; and 41 treat fluid flow, aerodynamics, and heat.

GENERAL DISCUSSION ON HEAT TRANSFER

Published November 1952. $10.00—This is an authoritative reference on a decade's development in heat transfer and in the design of apparatus relating thereto. The 93 contributions and discussions in its 500 pages provide first-hand information on heat transfer with change of state; heat transfer between fluids and solids; conduction in solids and fluids; radiation, instrumentation, measurement techniques and analogies; special problems such as heat transfer in turbine blade cooling, in liquid metals, in gas turbines, in piston engines, the mercury boiler, etc.

SHOCK AND VIBRATION INSTRUMENTATION

Published 1952. $3.00—Concerned with the characteristics of shock and vibration instruments, and their use in testing, this book describes the behavior of conventional spring-mass damping instruments, peak reading gages, reed gages, and statistical gages. It discusses methods of calibration, sources of error and secondary effects, and applications of instrumentation to broad fields such as to studies of blast effects and ship vibration.

HIGH PRESSURE MEASUREMENT

Published 1953. $3.00—Topics dealt with include: Advances in the field, piston ring as a precision measuring instrument, gold-chrome in H.P. wire gage, techniques and equipment for generation of dynamic pressures, design and test of gage for measurement of high speed transient pressures, factors in fabrication and operation of H.P. pumps, automatic pneumatic pressure controller for regulating the flow of hydrogen, rupture disc design evaluation, gaskets for H.P. vessels, design and application of control volume pumps for high pressures, seals to minimize leakage, influence of residual stress on behavior of thick wall closed end cylinders, and a static-dynamic load machine for high pressures.

DIESEL FUEL OILS

Published in 1948. $3.50—Reviews refining techniques, the chemistry and properties of the preferred hydrocarbons used in the Diesel power field, and the theory and fundamental factors affecting the combustion of Diesel fuel oils.

PROCEEDINGS, 1952 OIL AND GAS POWER DIVISION CONFERENCE

Published December 1952. $3.00—Subjects include heat transmission in internal-combustion engines; investigation on hydrogen foam from the shrunk-on part of web and journal of Diesel engine crankshafts; dynamic shear modulus apparatus and production test results for a cast crankshaft alloy; torsional vibration; lubrication problems in design of heavy duty engines; bearing operation; combustion fundamentals of heavy duty gas engines; high-compression gas engines; electrical ignition of high compression engines; Diesel power plants vs. steam power plants; engine cooling at elevated temperatures.

MODERN REHEAT TURBINES AND BOILERS

Published 1952. $2.00—Aspects of reheating treated include advantages and disadvantages of the reheat cycle; normal, start-up, quick start-up, and shutdown of modern reheat boilers; design factors relating to performance and operation of reheat boilers; performance of several new reheat boilers and special features of operation; starting schedules after shutdown of various durations; reheat economies; conversion to centralize control of auxiliaries; temperature control; turbine overspeed control as affected by reheat; and reheat development during the past twenty-five years.

GAS TURBINE PROGRESS REPORT—1952

Published in February; 1953 ASME Transactions. $1.50—This Report covers gas turbine applications in automotive, railroad, aviation and marine fields, in the central station and in specialized industries. It also surveys the progress that has been achieved in improving materials, cooling methods, fuels, and performance of gas turbine components. Probable future trends are forecast, and consideration is given to the important problems which have to be solved before the gas turbine can be more generally applied.

A GLOSSARY OF TERMS IN NUCLEAR SCIENCE AND TECHNOLOGY

J1	General Terms (I)	$1.00
J2	Reactor Theory (II)	1.50
J3	Reactor Engineering (III)	.75
J4	Chemistry (IV)	.60
J5	Chemical Engineering (V)	.60
J6	Biophysics and Radiobiology (VI)	.60
J7	Instrumentation (VII)	1.00
J8	Isotopes Separation and Metallurgy (VIII and IX)	1.20

1952 ASME UNFIRED PRESSURE VESSEL CODE

Published March 1953. $4.50—This Revision covers the use of all classes of materials and methods of fabrication that have been approved for Code construction. Its specific requirements are for fabrication of vessels of carbon and low-alloy steels, nonferrous materials, high-alloy steel, cast iron, and clad and lined materials by riveting, welding, forging and brazing.

1952 QUALIFICATION STANDARD FOR WELDING PROCEDURES, WELDERS, AND WELDING OPERATORS

Published 1952. $1.00—These rules apply to the qualification of welding procedures and welder performance for all types of manual and machine arc and gas welding processes permitted in other sections of the Code; and to testing welders ability to make sound welds.

1952 BOILERS OF LOCOMOTIVES CODE

Published March 1953. $1.25—The rules of this Code apply to boilers which are not subject to federal control. They cover such details as materials, working pressures, thickness of plates and tubes, riveting, valves and fittings, welding, and stamping.

1952 MINIATURE BOILER CODE

Published April 1953. $1.00—These construction and fabrication rules are for boilers that do not exceed the following limits: 16 in. inside diameter of shell, 42 in. over-all length of outside to outside of head at center, 20 sq. ft. water heating surface, and 100 psi maximum allowable working pressure.

CODE FOR PRESSURE PIPING

B31.1 – 1951. With Supplement No 1., B31.1a-1953. $4.00—Covering power, gas and and air, oil, district heating, refrigeration piping systems, this Code provides minimum safety requirements for the selection of materials, designation of dimensional standards, the design and erection of the systems, and the tests of the elements before erection and of the completed systems after erection.

ACCURACY OF ENGINE AND TOOL ROOM LATHES

B5.16-1952. $1.00—Here are given the tolerances to which industry is building 12 to 18 in., 20 to 32 in., and 48 to 72 in. lathes; and the test requirements for checking accuracy and alignment.

MOUNTING DIMENSIONS OF LUBRICATING AND COOLANT PUMPS FOR MACHINE TOOLS

B5.20—1952. $1.00—These mounting dimensions are for pumps attached directly to the machine tool, and those attached to motors which in turn are attached to machine tools.

SQUARE AND HEXAGON BOLTS AND NUTS

B18.2—1952. $2.00—This new and greatly expanded Standard contains complete dimensional specifications as well as recommendations on standard materials.

GEAR DESIGN, DIMENSIONS, AND INSPECTION

S1	20-Degree Involute Fine-Pitch System for Spur and Helical Gears	B6.7 —1950	$1.50
S2	Fine-Pitch Straight Bevel Gears	B6.8 —1950	1.00
S3	Design for Fine-Pitch Worm Gearing	B6.9 —1950	1.50
S4	Inspection of Fine-Pitch Gears	B6.11—1951	2.50

TEST CODE FOR STEAM TURBINES

Published 1949. $2.00—Provides standard methods for testing all types of modern steam turbines as well as complete instructions for making the necessary pressure-temperature and flow measurements, and for making corrections to test performance.

URANIUM, PLUTONIUM AND INDUSTRY

Published December 1952. $1.50—Outlines the Atomic Energy Commission's production program, sketches the research and development network, discusses applications of atomic energy, and lists sources of information on the atomic energy field.

ASME SCREW THREADS MANUAL FOR SHOP AND DRAFTING ROOM

Published March 1953. $2.50—The Manual gives shopmen a practical substitute for the American Unified Standards for Screw Thread and their Gages. It contains only the most used and essential standard dimensions, i.e., coarse, fine, and 8-pitch series of classes 2A and 2B from the smallest to those of 1 ½" nominal diameter concise descriptions of the thread features and applications, and important related information not found in the Standards.

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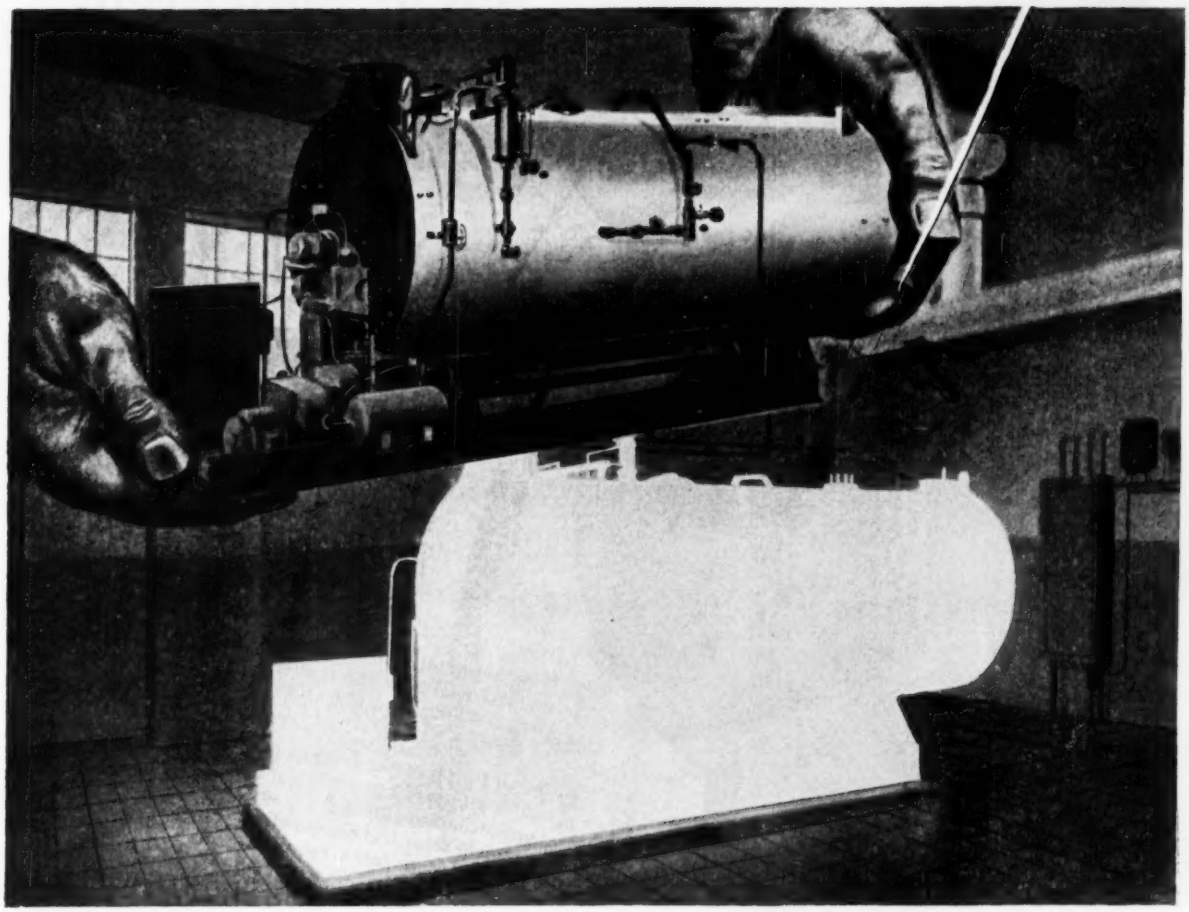
Here's why you get more...when you buy a Cleaver-Brooks Self-Contained Boiler



...only Cleaver-Brooks can offer you the experience gained from more than 20 years of pioneering . . . and more than 12,000 individual "packaged" boiler installations

CLEAVER-BROOKS pioneering has been largely responsible for simplifying boiler buying . . . lowering costs of installation . . . delivering 80% guaranteed steam efficiency from every fuel dollar.

Boilers can be shipped as completely assembled and tested self-contained units, with auxiliaries as required. Installation involves minimum of time, construction and space. Usually connections only to steam, fuel, water lines and electrical service are needed. No special foundations are required. A short vent takes care of exhaust gases. Frequently, boilers are ready for use in a matter of *hours*, depending on availability of service lines.

Cleaver-Brooks, originators of the self-contained boiler, offers wider experience that counts in another important way. Qualified engineers help you plan steam plants tailored *exactly* for your needs. Carefully analyzed are loads, space and equipment arrangement. This not only helps you solve present steam needs, but adds flexibility for future expansion as well.

This application engineering, plus basically sound design and construction is your assurance of a full return from your boiler investment. When you specify a self-contained boiler — make sure it's a Cleaver-Brooks.

Cleaver-Brooks steam or hot water boilers for heating and processing are available for oil, gas or combination oil/gas firing. Sizes: 15 to 500 hp, 15 to 250 psi. Write for Catalog AD-100.

CLEAVER-BROOKS COMPANY
Dept. J,319 E. Keefe Ave.
Milwaukee 12, Wisconsin, U.S.A.

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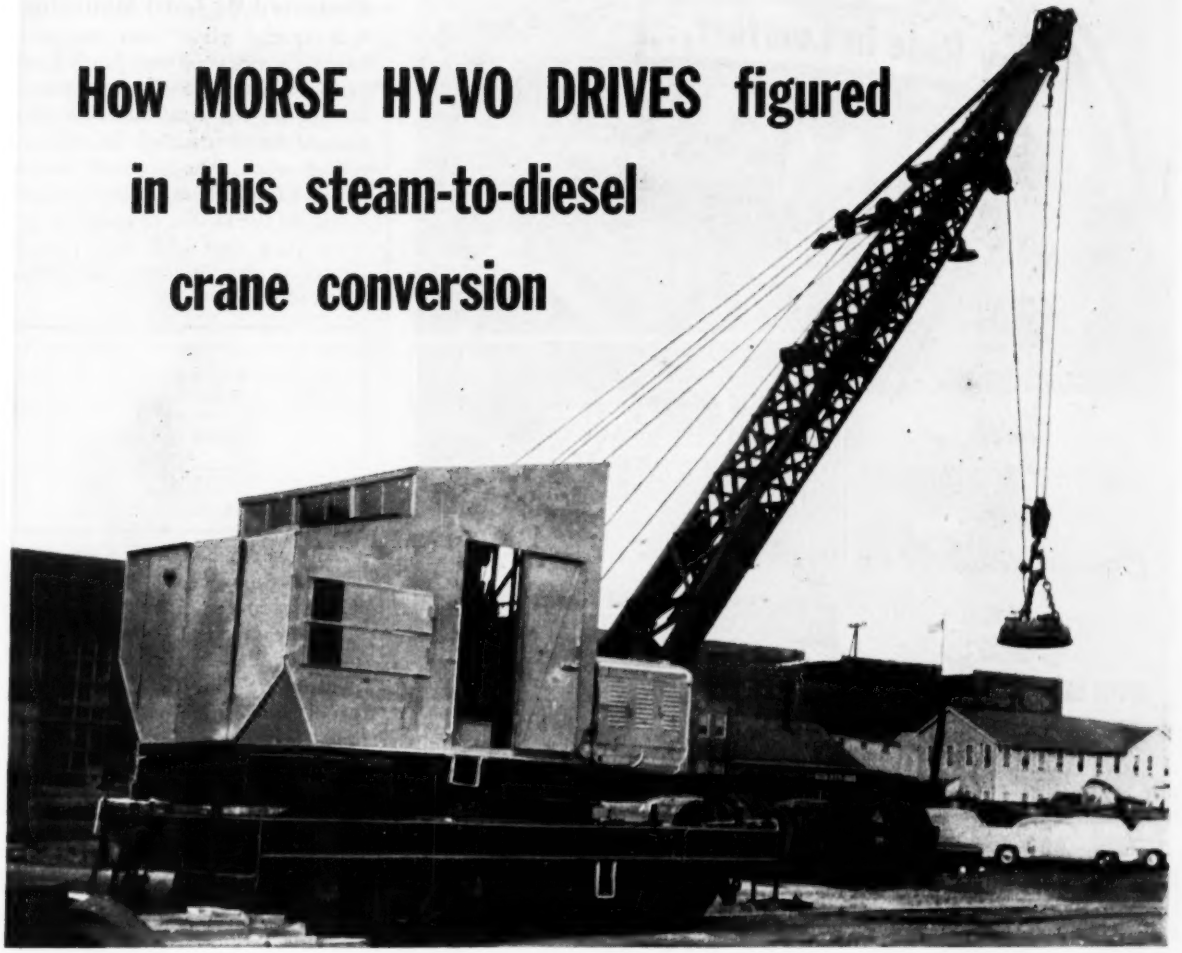
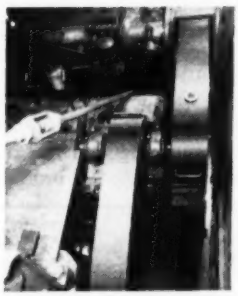
ORIGINATORS OF THE SELF-CONTAINED BOILER
Steam Boilers • Oil and Bitumin Tank Car Heaters • Distillation Equipment
Oil and Gas Fired Conversion Burners

How MORSE HY-VO DRIVES figured in this steam-to-diesel crane conversion





Inset shows encased Morse Hy-Vo Drives. Note narrowness of drives in relation to 165 hp. power-transmission requirements.

After thirty-four years as a steamer, this Browning locomotive crane owned by Edgewater Steel Company was converted to diesel power.

Its new power equipment: A Cummings 165 hp. engine with a torque converter drives a 1″ x 4″ Morse Hy-Vo Drive, connecting converter output shaft to jackshaft, second reduction is made with a 1″ x 5″ Morse Hy-Vo Drive.

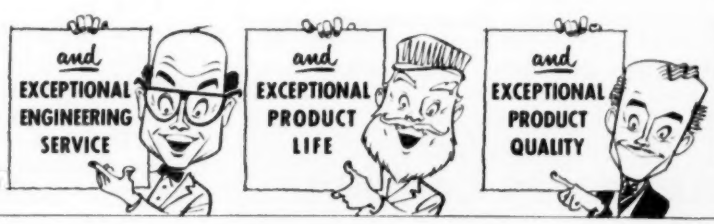
Results: Smoother, more positive control, more reserve power. Operating cost per year cut from $11,232.00 to $7,887.36, a savings of $3,344.64.

Morse Hy-Vo is especially suited to steady or intermittent transmission of heavy loads in cramped space.

In fact, Hy-Vo can transmit up to 5000 hp., run at linear velocities of 6500 fpm. and speeds of 3600 rpm. At the same time, it gives up to one-third longer service life, reduces operating and maintenance costs as much as 50%; runs coolly, quietly, smoothly with less than 1% friction loss. In most instances, it does away with bulky outboard bearings.

With just these few facts in mind, *think* of the advantages in design and function opened to you by Morse Hy-Vo Drive. Write us for details on Hy-Vo in your applications, or let us send you Hy-Vo Catalog C72-51. Morse Chain Company, Dept. 512, 7601 Central Avenue, Detroit 10, Michigan.

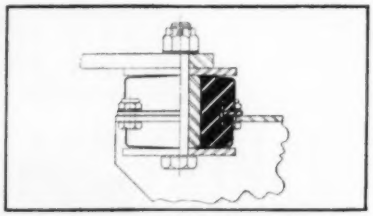
M=PT
MORSE *means* POWER TRANSMISSION



MORSE BW
MECHANICAL POWER TRANSMISSION PRODUCTS

Railroad Equipment Protected By Lord Mountings

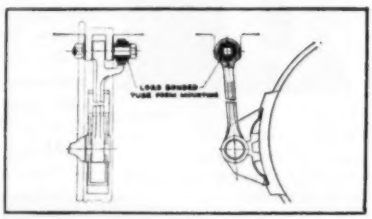
A special plate form mounting has been designed by Lord Engineers for use as a shock mounting for engine-generator and motor-compressor units installed on railroad rolling stock. The problem was to design a Lord Mounting which would minimize the shocks of coupling and uncoupling cars and thus prevent damaging the undercar equipment referred to above.



An existing Lord plate form mounting design was utilized with a steel tubing insert in the elastomer to increase the stiffness of the mounting. Tooling and research expense were thus saved by this unusual application of Lord Mountings previously designed to solve another similar problem.

Excessive Wear Eliminated By Use of Lord Mountings

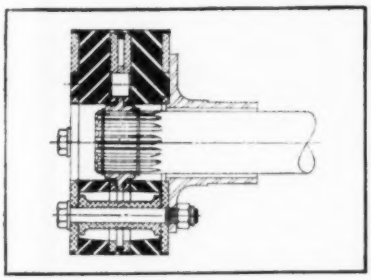
A recently designed Lord Mounting has solved a problem for a manufacturer of brake assemblies in the railroad field. A Lord Tube Form Mounting design was utilized as a joint for the brake hanger mechanism. Through the use of rubber bonded to metal sufficient motion was permitted to compensate for shock while eliminating wear on the pin and joint at the point of motion.



Lord Engineers determined the amount of resiliency required to effect a firm joint while permitting sufficient movement to eliminate excessive wear. An existing design was used with the correct elastomeric compound to meet the necessary requirements. Thus a considerable saving was achieved.

Lord Flexible Coupling Flies With Kaman Helicopter

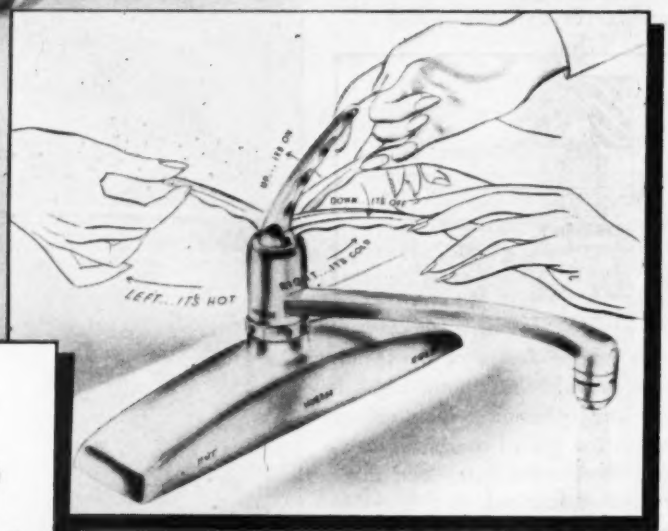
The Kaman K-5 helicopter presents an interesting application of the LORD J-5329-2 flexible coupling with the Boeing 502-2 gas turbine. The function of the coupling in this case is to absorb the torsional vibrations of the system and isolate the turbine from the rotors. However, the unit also serves to accommodate angular or parallel misalignments due to manufacturing tolerances or dynamic motions.



The unique design of the installation provides maximum accessibility and economical maintenance through the use of concentric driving and driven shafts. The inner member of this pair is the engine shaft which drives the coupling hub through a splined connection. Precompressed against the splined hub are the two bonded rubber coupling halves which transmit the engine torque in shear of the rubber. Four through-bolts connect the outer plates of the coupling halves to the driven hub and also serve as the safety interlock in case the rubber sections are destroyed. The first gear of the transmission is mounted on this driven hub and feeds power on through the system in to the helicopter rotors.

For over thirty years the Lord organization has specialized in designing and producing Bonded Rubber Flexible Couplings, Vibration and Shock Control Mountings and Component Parts. The capabilities of Lord Engineering have proved their worth to designers of industrial and automotive equipment in many diversified fields as is indicated in this instance.

Moen Single-Handle Faucet, made by Moen Valve Co., Division of Ravenna Metal Products Co., Seattle 5, Washington.



Sketch showing operation of Moen Faucet, which can be operated by one hand, giving water at the desired temperature at any rate of flow. You can change volume without changing temperature, or change temperature without changing volume, or select the desired temperature before turning on the water. Available in various styles and types.

Faucet maker finds **unit cost more important** than cost per pound

This Moen Faucet is unusual. First, its design represents a new idea in faucets so far as we know. If we are wrong, we will welcome the correction. But in any event, this modern faucet is selling like mad; people really want its convenience, its simple operation, its one-hand control. The second unusual thing about the faucet is that the spout is made of Admiralty Metal, supplied by Revere. This metal was chosen by Moen after consultation with the Revere Technical Advisory Service, which pointed out the qualities of Admiralty from the standpoints of bendability, and plating characteristics. Everything considered, the "more expensive" Admiralty turned out to be less expensive in the end, and more satisfactory both to the Moen Valve Co. and to its customers. The faucet also uses Revere Free-Cutting Brass Rod for interior machined parts, this again being chosen for workability and corrosion resistance. Service to Moen and to many other industries in the Mountain State area is of course provided by the Revere sales, technical and mill personnel on the Pacific Coast. Similar services are of course available from Revere everywhere in this great country. To obtain the Revere services, see the nearest sales office.

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Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

FARVAL—*Studies in Centralized Lubrication* No. 142

FARVAL SAVES DOLLARS

and many production hours on 4 Minster presses

THE press room is the bottleneck in any sheet metal plant. If presses are shut down for oiling or repair of bearings due to faulty lubrication, the entire manufacturing operation grinds to a halt. Production is lost.

To avoid these troubles in its plant, Lyon Metal Products, Inc. installed Farval centralized systems of lubrication on their four Minster presses. The results were immediate: Farval resulted in considerable savings in labor and lubricant over a three-year period. But better than that, Farval freed these presses for their real work of high-speed, non-stop production by eliminating the "human element" involved in frequent shutdowns for lubrication. Now, with a quick stroke, all points (regardless of location) on a machine are lubricated properly, effortlessly. In addition, the Farval system is sealed against dust and scale which inevitably get into bearings with old-fashioned oiling methods.

Farval is the original Dualine system of centralized lubrication that delivers oil or grease under pressure to a group of bearings from one central station, in exact quantities, as often as desired. The Farval valve has only two moving parts—is simple, sure and foolproof, without springs, ball-checks or pinhole ports to cause trouble.

Today, Farval is working in hundreds of metalworking and processing shops protecting bearings on presses, coilers, shears—in fact, every type of equipment that must be lubricated regularly and properly.

If you want to lower production costs in your plant, you owe it to yourself to look into Farval. The savings will amaze you. Write today for free Bulletin 25. The Farval Corporation, 3264 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.

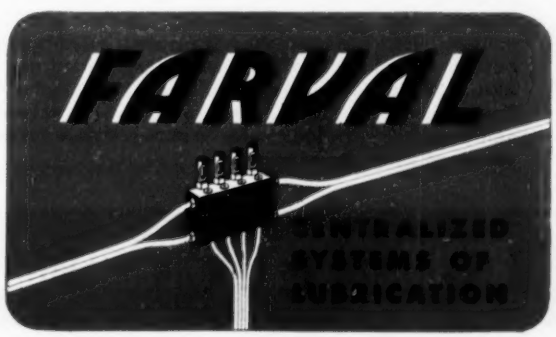
KEYS TO ADEQUATE LUBRICATION— Wherever you see the sign of Farval—the familiar valve manifolds, dual lubricant lines and central pumping station—you know that a machine will be properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.

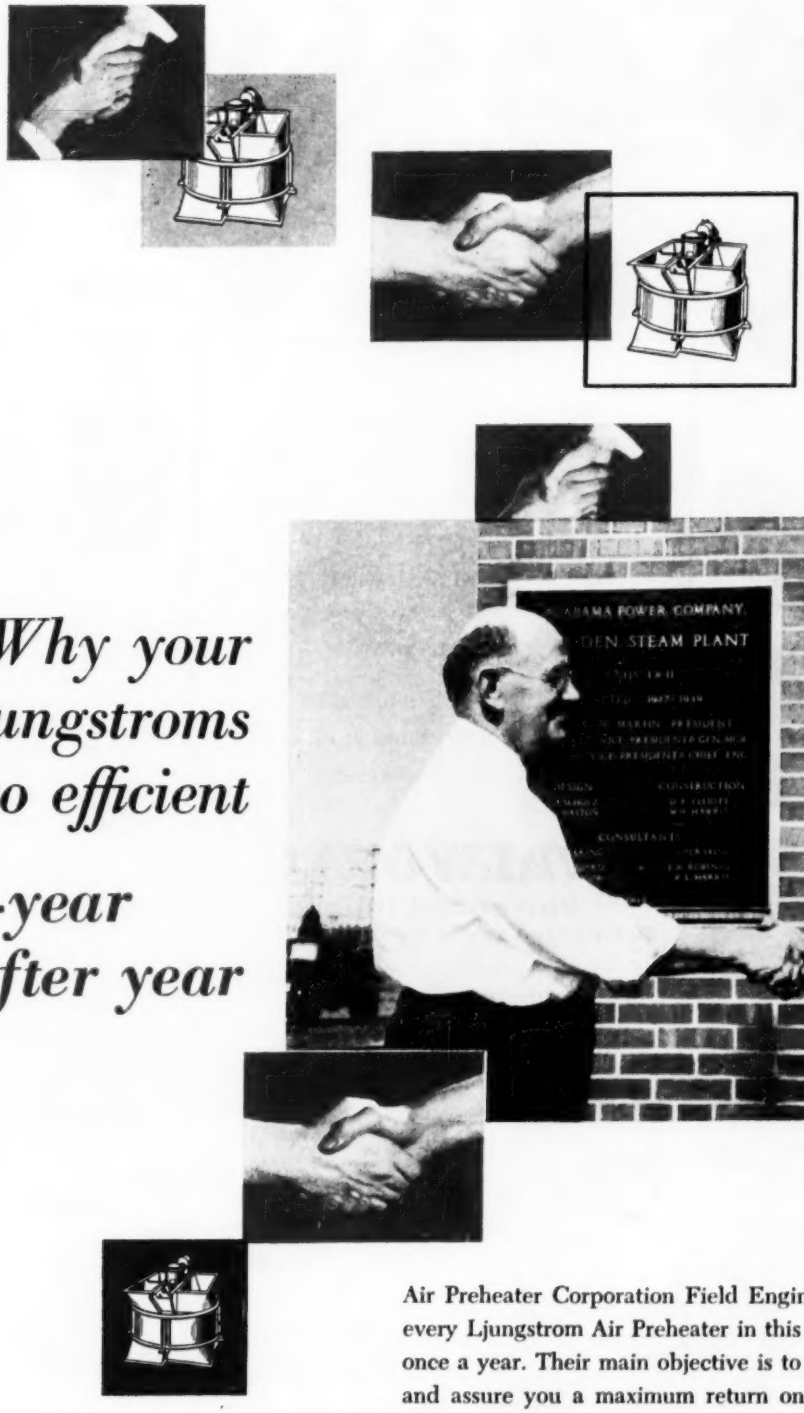
FARVAL SAVES ON LUBRICATING 4 PRESSES
(Savings based on one work shift per day)

	Lbs./Yr. lube. 64 points	Hrs./Yr. lube. 64 points
GREASE GUN	576 lbs.	208 hrs.
CENTRALIZED SYSTEM	144 lbs.	52 hrs.
SAVINGS EFFECTED IN 3 YEARS BY FARVAL	1296 lbs.	468 hrs.

AND IN ADDITION, FARVAL SAVES BEARING EXPENSE AND PRODUCTION TIME

Reports of lubrication engineers show lubrication by grease gun takes .747 minutes per point to clean dirt from nipples, grease, move from point to point and refill gun. With Farval it only takes .188 minutes per point to fill reservoir, build up and hold pressure, and lubricate. In addition, Farval saves 3 pounds of each 4 of lubricant used by other methods.





Why your Ljungstroms are so efficient

—year after year

Air Preheater Corporation Field Engineers aim to visit every Ljungstrom Air Preheater in this country at least once a year. Their main objective is to increase availability and assure you a maximum return on your investment. They are always available for consultation.

This is just another reason why the Ljungstrom Air Preheater is *the most economical heating surface on the modern boiler.*

THE AIR PREHEATER CORPORATION

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Walworth manufactures a *complete line* of Gate, Globe, Angle, Check, and Lubricated Plug Valves, made of Stainless Steel, Steel, Iron, Bronze, and Special Alloys in a wide range of sizes and temperature-pressure ratings.

Fittings of steel, iron, and bronze are also manufactured in all conventional types and sizes.

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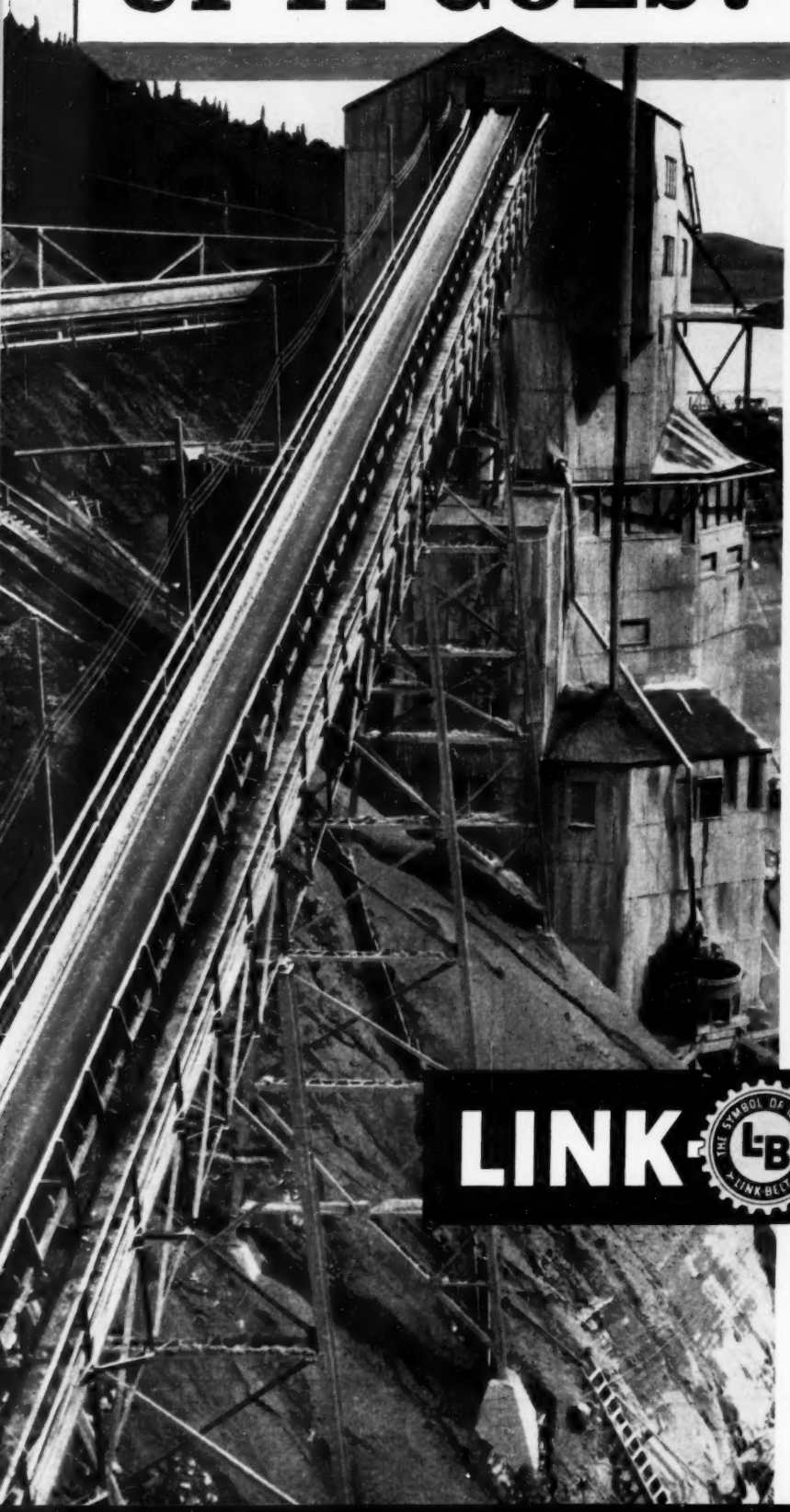
Distributors in principal centers throughout the world

LINK-BELT RESEARCH AND ENGINEERING . . . WORKING FOR INDUSTRY

UP IT GOES! 900 tons per hour



Here's how belt conveyor transportation cuts construction costs

In the photograph at left, a Link-Belt belt conveyor carried 900 tons per hour of sand and aggregate to a huge dam's mixing tower. Working continuously—without loading and unloading delays . . . with no loss of time for empty return trips—belt conveyors travel up or down grades as steep as 32 percent. Their light, compact structures cross mountains and marshes . . . travel over rivers, above city streets, through small tunnels.

The long-distance movement of materials to and from large construction jobs is just one example of their versatility. You'll find Link-Belt belt conveyors at work in mines and quarries . . . in foundries, mills and factories . . . loading and unloading boats and trains. In every case, high capacity goes hand-in-hand with low operating and maintenance costs.

At this very moment, new applications for belt conveyors are being explored as modern industry's tonnage requirements outgrow traditional means of transportation. And, as in so many industrial "revolutions," Link-Belt research and engineering are making far-reaching contributions. In fact, in almost any plant you visit, you can see evidences of Link-Belt developments that make the movement of materials and the mechanical transmission of power more efficient.

13,321

LINK-BELT

THE SYMBOL OF QUALITY — LINK-BELT — LB

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Executive Offices:
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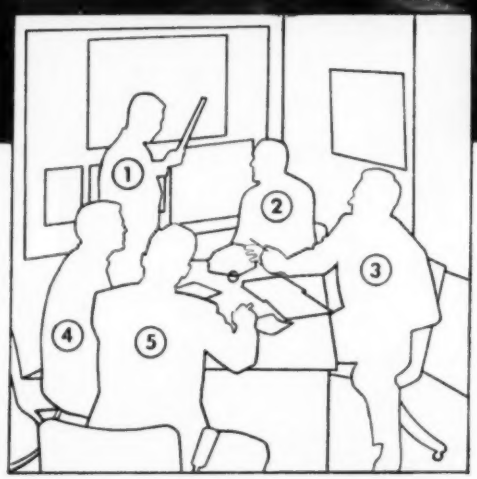
ONE SOURCE — ONE RESPONSIBILITY FOR MATERIALS HANDLING AND POWER TRANSMISSION MACHINERY



1. Westinghouse Application Engineer
2. Westinghouse Sales Engineer
3. Chief Engineer
4. Electrical Engineer
5. Production Superintendent

Your motor and control problems are local . . . so is Westinghouse application assistance

Do you put a full team on the field when you tackle a motor and control application problem? Are you cashing in on the know-how of your local staff of Westinghouse application engineers? Take a look at this line-up:

Your local Westinghouse sales engineer has a broad knowledge of all Westinghouse Motors and Controls. He knows their capabilities and limitations. He knows how to match motors and controls for maximum production.

Your local Westinghouse application engineer is equipped to analyze any motor and control problem and then develop the best solution. He can handle any application problem from a simple machine tool to a complete production line.

Your local Westinghouse product engineer is a specialist in one type of motor or control. These men work at the local level but operate from a manufacturing headquarters office.

Enlist the services of these men on your next motor and control application job. Call your local Westinghouse office for further details, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21746

Application engineers work out of 126 Westinghouse offices

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Appleton, Wis.	4-4116	Greensboro, N. C.	2-3415	Richmond 19, Va.	2-4758	Tampa 1, Fla.	2-7246
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Birmingham 3, Ala.	53-2411	Indianapolis 9, Ind.	MArket 3301	Saginaw, Mich.	4-2640	Washington 6, D. C.	NAtional 8-8843
Bluefield, W. Va.	3-9131	Jackson, Mich.	2-0519	St. Louis 1, Mo.	CEntral 1120	Waterloo, Iowa	4679
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Bridgeport 8, Conn.	4-0151	Jacksonville 6, Fla.	78-6492	San Antonio 5, Tex.	GArfield 5114	Wheeling, W. Va.	6222-6223
Buffalo 3, N. Y.	WAshington 3966	Jamestown, N. Y.	8939	San Diego 1, Cal.	MAin 8151	Wichita 2, Kansas	5-2631
Butte, Mont.	2-2301	Johnstown, Pa.	81-257	San Francisco 8, Cal.	EXbrook 2-5353	Wilkes-Barre, Pa.	3-1144
Canton 2, Ohio	3-9171	Kansas City 6, Mo.	HArrison 7122	Seattle 4, Wash.	MAin 0808	Williamsport, Pa.	4289
Cedar Rapids, Ia.	7638	Kingsport, Tenn.	3769	Shreveport, La.	4-5298	Worcester 8, Mass.	4-2648
Charleston, S. C.	9904	Knoxville 8, Tenn.	2-8101	Sioux City 4, Iowa	5-7634	York, Pa.	7851
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Chattanooga 2, Tenn.	7-4361	Louisville 2, Ky.	CLay 0212				
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Cleveland 13, Ohio	CHerry 1-7600	Memphis 3, Tenn.	8-8546				
Columbia, S. C.	3-8823	Miami 4, Fla.	2-1553				
Columbus 15, Ohio	MAin 5527	Milwaukee 2, Wis.	DAly 8-1800				
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Dallas 1, Tex.	Riverside 5231	Mobile, Ala.	8-5443				
Davenport, Ia.	3-2761	Nashville 3, Tenn.	42-3505				
Dayton 2, Ohio	ADams 9153	Newark 2, N. J.	MArket 2-0200				
Denver 2, Colo.	KEystone 8121	New Haven 10, Conn.	5-3191				
Des Moines 8, Iowa	2-0244	New Orleans 13, La.	RAymond 8656				
Detroit 31, Mich.	TRinity 2-7010	New York 5, N. Y.	WHitehall 3-4321				
Duluth 2, Minn.	7-1541	Niagara Falls, N. Y.	9700				
El Paso, Tex.	2-5691	Norfolk 10, Va.	5-1639				
Emeryville 8, Cal.	OLympic 2-3770	Oklahoma City 2, Okla.	REgent 6-1633				
Erie, Pa.	24-867	Omaha 2, Nebr.	HArney 8700				
Evansville 8, Ind.	5-7146	Peoria 3, Ill.	2-5439				
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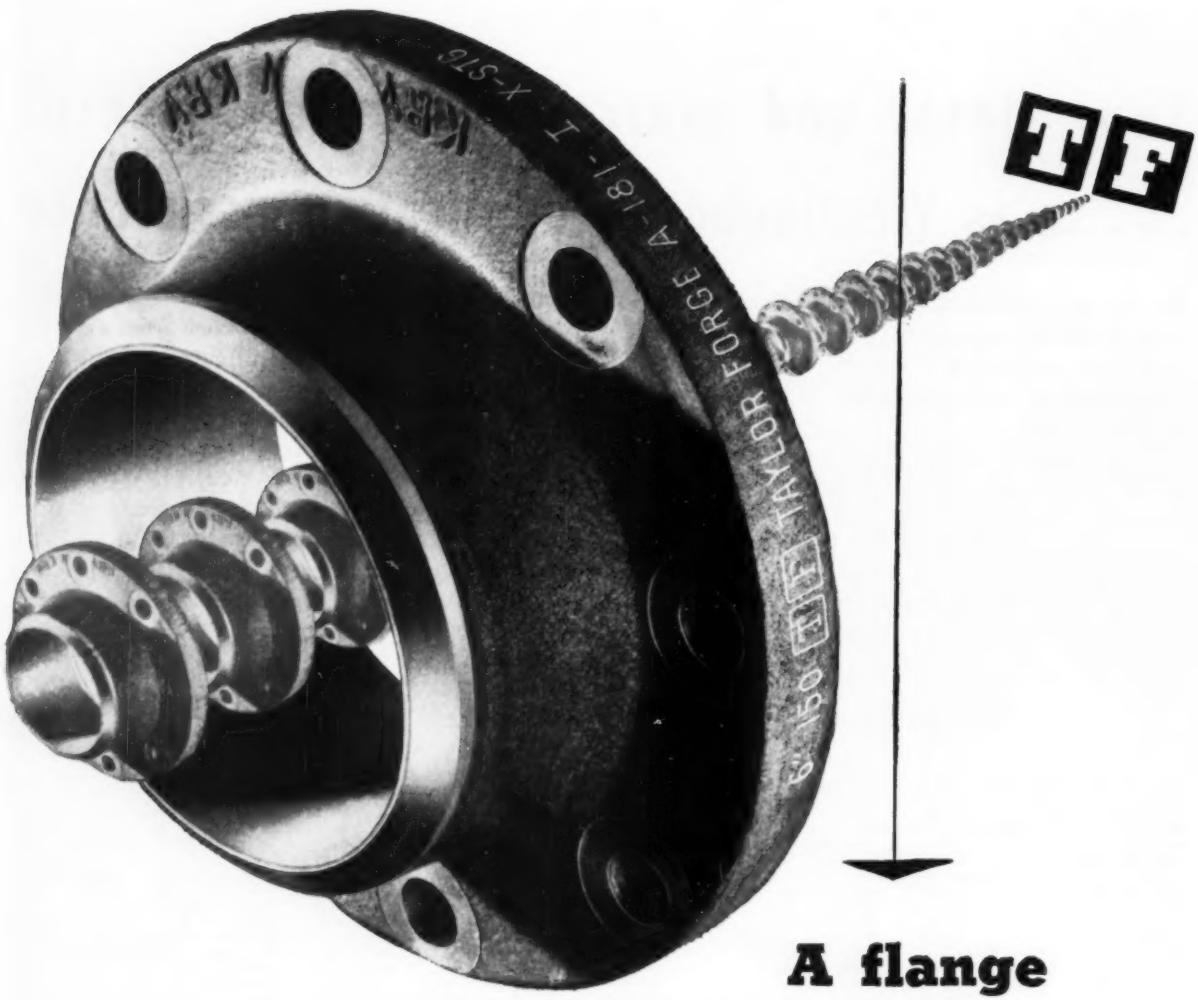

A flange with a background . . .

You are looking at a flange with a history. Taylor Forge made the forged steel flange and in a sense the forged steel flange made Taylor Forge. It was Taylor Forge, back in 1905, who made the first forged steel flanges on a commercial scale . . . and it is Taylor Forge who has guided flange development across the past half century.

Through the first threaded flange form, the bolted Van Stone form, and the perfected welding neck form pictured here, Taylor Forge has undeniably contributed more to flange development than any other organization*.

Taylor Forge Welding Neck Flanges are a part of the WeldELL® line—the line that more than 20 years ago gave industry the first complete line of fittings for pipe welding. The organization that led development is still leading . . . in scope of types, sizes, weights, materials . . . in quality and downright value!

For up-to-the-minute facts see your Taylor Forge Distributor

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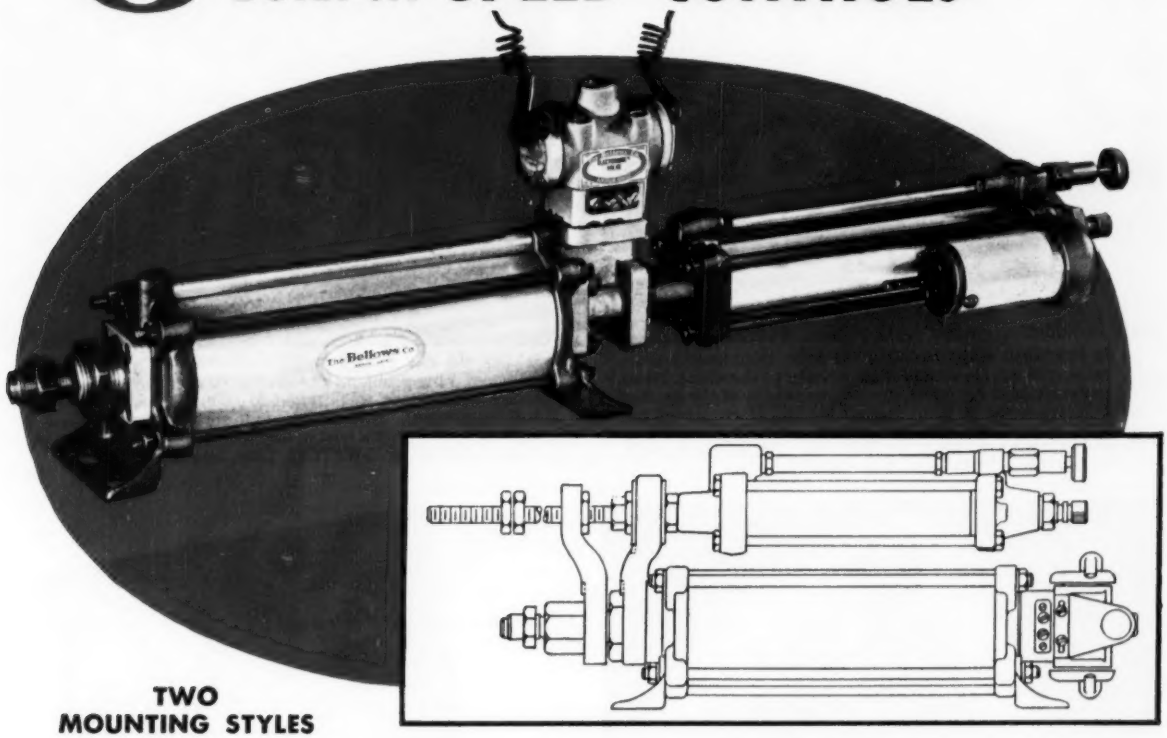
Plants at: Carnegie, Pa., Fontana, Calif., Gary, Ind., Hamilton, Ont., Canada

* When pressures rose from the old 150- and 300-pound standards to 400, 600 and finally 900 pounds, it was largely the exhaustive research of Taylor Forge that supplied the formulas for determining stresses in flanges for any given condition of loading. Among many examples: the Taylor-Waters formula, published in 1927, became and still is the basis of recognized practice for flanges in sizes through 24". Again, in 1938 Taylor Forge published the first edition of the now authoritative "Modern Flange Design" based on methods proposed by E. O. Waters, D. B. Rossheim, D. B. Wesstrom and F. S. G. Williams, Taylor Forge Manager of Engineering Standards. (ASME Trans., Apr. 1937)

This Air Cylinder Combines

1 BUILT-IN HYDRAULIC CONTROL
2 BUILT-IN ELECTRIC CONTROL
3 BUILT-IN SPEED CONTROLS



TWO MOUNTING STYLES

The Bellows Air Motor and Hydro-Check (Model HCB-EM) is available arranged in tandem as shown above, or in parallel, as sketched.

●

Combination units of Air Motor and Hydro-Check are also made with any one of six other Bellows directional valve arrangements; and, of course, Air Motors and Hydro-Checks are available as separate units.

In one compact packaged power unit are built-in controls to cover every phase of air cylinder operation. Built-in hydraulic control of piston rod movement gives the characteristic smoothness of hydraulic operation, yet retains the speed and flexibility of air power. Built-in electrically controlled directional valve permits quick, positive, remote control, or easy electrical synchronization with other machine elements. Built-in speed controls permit exact control of piston rod speed in either or both directions.

This combination of Bellows Air Motor and Hydro-Check is available in five bore sizes: 1¼", 1¾", 2½", 3⅝" and 4½" in standard stroke lengths up to 18".

Here is air cylinder power at its best — fast, flexible, safe, and smooth.

BULLETIN CL-50 TELLS THE STORY. WRITE FOR IT TODAY!
DEPT. ME-853

Controlled-Air-Power

The Bellows Co.

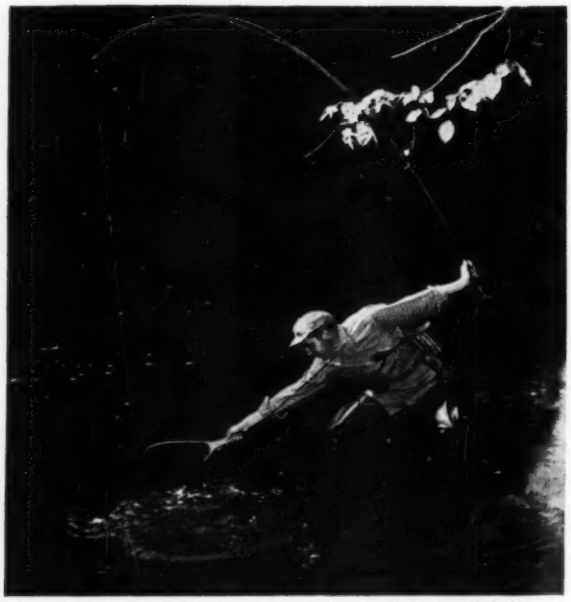
AKRON 9, OHIO

699-A

FOR FASTER, SAFER, BETTER PRODUCTION

How would YOU solve these 2 problems?

1. IN SOFTBALL MANUFACTURE the most troublesome problem was to obtain absolute uniformity in the kapok cores. These determined hardness, density and shape of the finished balls. H. Harwood & Sons, Inc., of Natick, Mass. solved this problem by molding the cores under hydraulic pressure at closely controlled high temperature. Two inexpensive THERMOSWITCH units per mold provide the needed temperature control at low cost.



2. TAKING THE STRETCH and shrink out of Nylon fish line posed a big problem. It can only be done under high heat. One manufacturer was quoted $18,000 for complicated control equipment. Instead — and very successfully — he stretches the line in a heated die, temperature-controlled by a Fenwal THERMOSWITCH. Cost, less than $25!

3. THIS IS IT — the Fenwal THERMOSWITCH control is simple — compact shell contracts or expands *instantly* with temperature changes, opening or closing electrical contacts. Adjustable and highly resistant to shock and vibration. Fenwal THERMOSWITCH units are solving temperature control problems and improving production throughout all industry.

4. SEND FOR THIS NEW CATALOG for complete explanation of the unique THERMOSWITCH unit. Also ask for more detailed, illustrated discussions of the problems above. Fenwal engineers will be glad to help you solve your temperature control problems involving heat, humidity, radiant heat, pressure and other variables. Write **Fenwal Incorporated, 58 Pleasant Street, Ashland, Massachusetts.**

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THERMOSWITCH®

Electric Temperature Control and Detection Devices

SENSITIVE . . . but only to heat

BOILERS

10 STORIES HIGH!

Three new B-I-G boilers on the West Coast will have all of the cost-saving advantages of B-L tube-supported wall enclosures and Texad* finishes. The order for one of them—a 1,250,000-pound-per-hour unit—has just been placed. Construction on the others—850,000-pound-per-hour boilers is now being started.

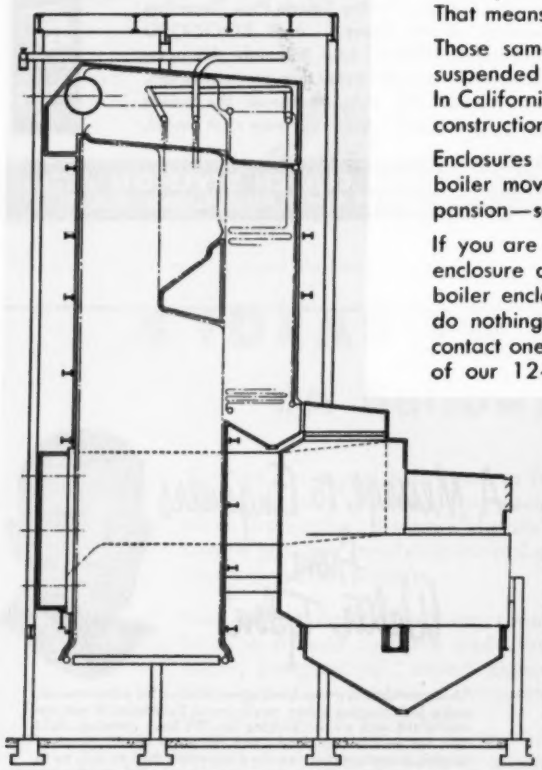
That means they'll cost less, save steel, operate more efficiently.

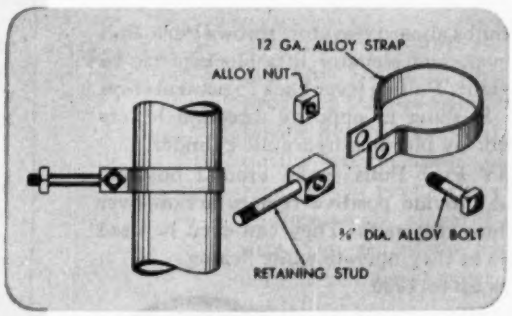
Those same advantages can be earned by specifying Bigelow-Liptak suspended settings for any large size industrial or public utility boiler. In California, for example, the king-sized, 10-story boilers will have lower construction and material costs and will not need tough-to-get steel plate.

Enclosures will be tighter, too. Tube-supported walls breathe with the boiler movements and TEXAD* flexes itself right along with boiler expansion—something that a steel plate casing that large could never do.

If you are building a large boiler, or a small one, insist on a separate enclosure quotation. You'll save plenty and you'll get a specially-made boiler enclosure engineered for your particular furnace by people who do nothing else but build furnace enclosures. Write Detroit today, or contact one of our conveniently-located offices. Be sure to ask for a copy of our 12-page tube-supported wall catalog—and a TEXAD* folder.

*T. M. REG.





One method B-L uses to fasten the enclosure to the tubes without welding into the tube. Tile-supporting castings are hung on the studs.

3133

BIGELOW-LIPTAK *Corporation*

and Bigelow-Liptak Export Corporation

2550 W. GRAND BLVD. • DETROIT 8, MICHIGAN

UNIT-SUSPENDED WALLS AND ARCHES

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an ACCO product

TRU-LAY PUSH-PULL CONTROLS

TRU-LAY Push-Pull Operates Ice Truck Elevator

• Man climbs aboard elevator, throws Push-Pull control lever, and elevator lifts block of ice to desired height. Pulling lever back to neutral stops elevator. Pushing in opposite direction lowers the elevator by bleeding hydraulic cylinder.

TRU-LAY Push-Pulls snake around obstructions, and provide positive remote action over short or long distances. They can even be used on shakers as they operate while flexing. Capacities up to 1000 pounds input.

If you have a remote control problem write our Detroit office today for a copy of DH-287

TRU-LAY PUSH-PULL CONTROLS

ACCO

AUTOMOTIVE AND AIRCRAFT DIVISION
AMERICAN CHAIN & CABLE

601 Stephenson Bldg., Detroit 2
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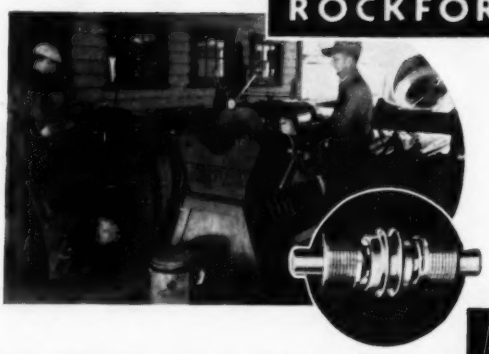
CLUTCHES by ROCKFORD

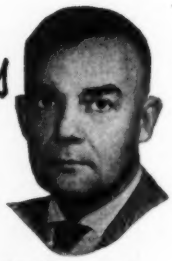


Provides Mechanized "Muscles" for Pipe Threading Jobs

Much of the manual labor has been taken out of pipe threading by the Toledo Pipe Threading machine shown above. And ROCKFORD Pullmore CLUTCHES help it handle this operation much faster and better than previous cutters. Let ROCKFORD help modernize the power transmission control design for *your* next model.

ROCKFORD CLUTCH DIVISION BORG-WARNER
1307 Eighteenth Avenue, Rockford, Illinois, U. S. A.

A Message to Engineers from Walter Tydon*



"A secure future, exceptional opportunities for advancement, and a high starting salary await you at FAIRCHILD, if you are one of the men we are looking for. We have openings right now for qualified engineers and designers in all phases of aircraft manufacturing; we need top-notch men to help us in our long-range military program: turning out the famous C-119 for the U. S. Air Forces.

"FAIRCHILD provides paid vacations and liberal health and life insurance coverage. We work a 5-day, 40-hour week.

"If you feel you are one of the men we are looking for, write me. Your inquiry will be held in strictest confidence, of course."

Walter Tydon

*Walter Tydon, widely known aviation engineer and aircraft designer and veteran of 25 years in aviation, is Chief Engineer of Fairchild's Aircraft Division.

ENGINE AND AIRPLANE CORPORATION
FAIRCHILD Aircraft Division
HAGERSTOWN, MARYLAND

4 IDEAS TO HELP YOU SAVE
on Bellows Assemblies

IDEA NO. 1 You can get expert help from us for any application where bellows assemblies are used . . . where there's a design problem involving control of temperature or pressure.

IDEA NO. 2 You can get from us bellows assemblies designed to open and close valves, dampers, etc., absorb expansion, provide packless construction and to do many more jobs.

IDEA NO. 3 You can get from us bellows assemblies made to your specific requirements—to give you better performing products and equipment.

IDEA NO. 4 You make cost-savings, too, when you turn over to us your current or projected bellows assemblies requirements. Skilled personnel assure you quality workmanship. Ample facilities can produce for you in any volume—wide range of metals and sizes. You get *all* the advantages of our half-century of experience in this specialized field.

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FULTON SYLPHON DIVISION Knoxville 4, Tenn.

Robertshaw-Fulton CONTROLS COMPANY "EVERYTHING'S UNDER CONTROL"

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"All motors are NOT alike!"

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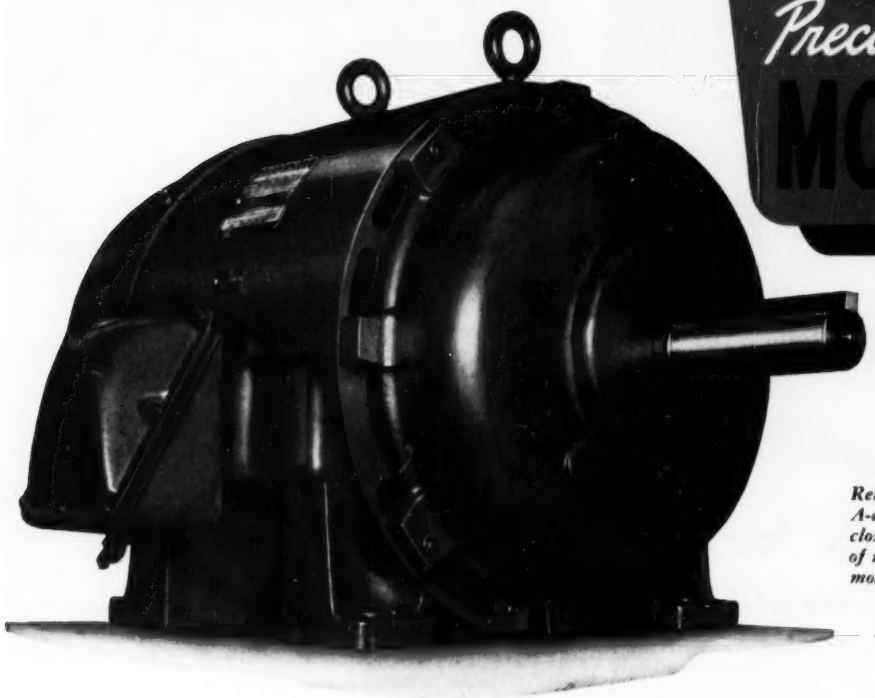

Reliance Totally-enclosed Fan-cooled A-c. Motor. All other standard enclosures available, with wide choice of mechanical designs and special mountings. Ratings from 3/4 to 300 hp.

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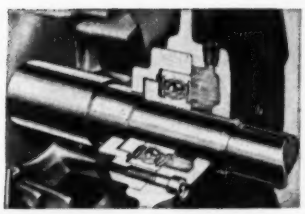
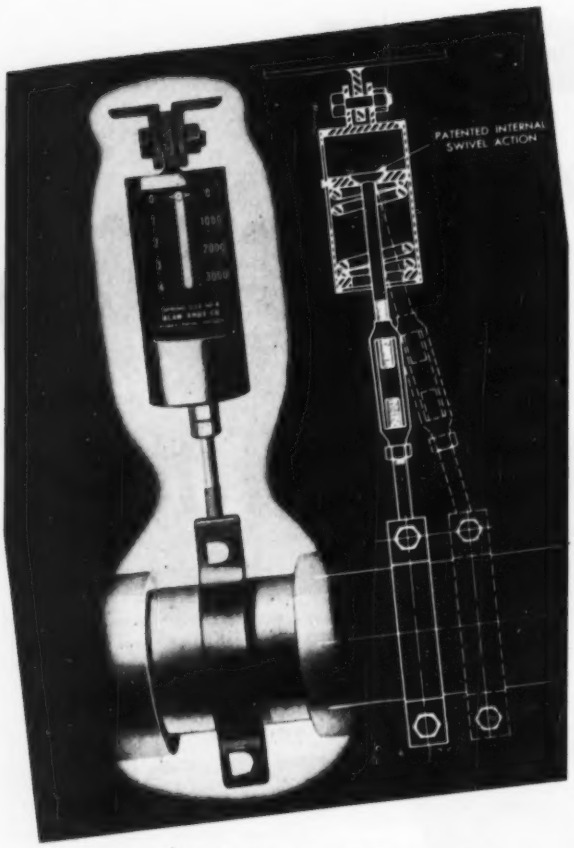


. . . AND THE BEST PRE-LUBRICATED BEARING DESIGN

The Reliance pre-lubricated bearing provides *four times more operating hours without re-lubrication* than any other bearing used in motors today. And—whatever your lubrication schedule—*you just can't grease 'em wrong!* To get the complete "inside story" on motor bearings, write today for Bulletin B-2201. It contains hard facts on the advantages of the Reliance pre-lubricated bearing design, with cutaway view, cross-section diagram, comparison chart, and statements by bearing manufacturers. B-1458 J

RELIANCE ELECTRIC AND ENGINEERING CO.

1062 Ivanhoe Road, Cleveland 10, Ohio • *Sales Representatives in Principal Cities*



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Whether the installation calls for Rigid Hanger Assemblies, Functional Hangers, Vibration Eliminators or Overhead Roller Assemblies, you'll find each furnished as a complete unit designed to do the best job. Blaw-Knox pioneered in this field and has brought to it many improvements in hanger design—including the patent Internal Swivel Action which permits both lateral and longitudinal movement, while the hanger case itself remains vertical. Engineers who have solved some of the toughest hanger problems are available at all times to apply their experience to any installation that presents difficulties.

For complete technical data and time-saving information on hanger locating, send for Catalog No. 51.

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Standard X-WASHERS

● If you have a design problem involving fasteners, make STANDARD X-WASHERS the profitable solution. The split-second locking action of STANDARD X-WASHERS will slash production time and costs.

Remember, no *special* tools are needed. A pair of pliers presses STANDARD X-WASHERS to a positive 360° enclosure and removes them just as easily when servicing is necessary. Fit them into your designs. Their applications are numerous.

FREDDIE FASTENER TALKIN': We can provide grooved pins for all sizes of STANDARD X-WASHERS... parallel or headed type pins made to specifications. Send print... or write for X-WASHER catalog and order by number. You'll receive a prompt quotation.

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Positions Open—Positions Wanted—Equipment, Material, Patents, Books, Instruments, etc. Wanted and For Sale

Answers to box number advertisements should be addressed to given box number, care of "Mechanical Engineering," 29 West 39th St., New York 18, N. Y.

POSITIONS OPEN

RATES Classified Advertisements under this heading in MECHANICAL ENGINEERING are inserted at the rate of $1.70 a line. $1.35 a line to members of ASME. Seven words to the line average. A box number address counts as one line. Minimum insertion charge, 5 line basis. Display Advertisements carried in single column units of multiples of one inch at flat rate of $28 per inch per insertion. Copy must reach us not later than the 10th of the month preceding date of publication.

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Responsible permanent position in new section of established company.

Graduate, age 35–50, experienced in chemical industry design including pressure vessels, piping, materials and specifications.

Paid holidays . paid vacation . low cost group health, accident, and life insurance . retirement plan.

Salary commensurate with ability and experience.

Submit resumé of personal history . education . experience . salary expected.

Application confidential.

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NITROGEN DIVISION
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We now have openings for Junior and Senior Mechanical, Electro-Mechanical, Electronic, Hydraulic and Structures Engineers to participate in and direct product development and design programs.

Applicants should have a minimum of three years' experience along product development and design lines.

Excellent working conditions in modern research laboratory. Professional development and advancement fostered. Paid vacations—sick leave—low cost group health—insurance—retirement programs.

Send resumé of education and experience to

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Graduate engineer with imagination and familiarity with patent procedures. To review new designs for novelty; supervise disclosure and record keeping of new ideas; serve as liaison between Company and its Patent Counsel. Opportunity also for personal participation in product development and research. Principal products are shock and vibration isolators of great variety.

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M.E. or Ch.E. sales and design of heat exchangers. Must have minimum of 2 years in this type of work. Excellent future for right man.

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TEL. 2-4441.

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Ph.D. for liaison between engineering and physics groups. Maturity is a requirement and four to six years' experience, which could be as mechanical engineer while working toward Ph.D. Work involves constant personal contacts. Write

Los Alamos Scientific Laboratory
of the
University of California
Attn: John A. Stevenson, Los Alamos, N.M.

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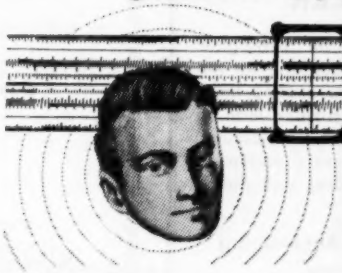
Graduate Mechanical Engineers for design and project engineering positions. Outstanding opportunities due to expansion of eastern chemical manufacturing company. Salary commensurate with experience and qualifications. Submit resumé indicating age, education, experience and salary expected. All replies will be treated in strict confidence.

The Davison Chemical Corporation
Curtis Bay Works
Baltimore 26, Maryland

Still the Wise Choice



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Positions are now open in the following fields as well as numerous others:

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Today, as in the past, engineers look upon du Pont as a better place to build a solid future. This is not surprising. For, as a du Pont engineer, they enjoy the prestige of working with one of America's great industrial leaders; the stability inherent in its over 1200 products serving more than 20 different fields; the vast resources of its 76 plants and 40 laboratories throughout the country; and the challenge and opportunity provided in an expanding industry.

Please do not apply if you are utilizing your highest skills in defense industry.

Please send complete resume to Mr. W. N. Nesbitt
Engineering Dept., Personnel Section

E. I. du Pont de Nemours & Co., Inc.
Wilmington, Delaware

Eight Pages of "OPPORTUNITIES"

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A mature engineer with administrative ability and a broad practical background of experience in construction, plant design, mechanics and cost estimation, to assume charge of Engineering Department. Experience in flotation and non-metallic minerals beneficiation is desirable. The scope of the work covers producing mines and plants in the western and southern states.

Please address replies to:
PERSONNEL MANAGER
BAROID SALES DIVISION
NATIONAL LEAD COMPANY
P. O. BOX 1675
HOUSTON, TEXAS

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We need three design engineers who have had at least 10 years' experience designing machinery. These men will create new designs and improve the design of our current equipment. Our products include plastics, high vacuum, pharmaceutical, and metal-working equipment. We are a sixty-year old progressive company and our "fringe" benefits are tops in the industry. Salary is open. Please send complete resumé to the Chief Engineer at:

F. J. Stokes Machine Company
5500 Tabor Road
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Capable of directing 500 man plant engaged in precision automotive parts production. Responsibilities include complete control of manufacturing standards and methods, quality control, process engineering, industrial relations, and other operational functions.

Position requires man with several years' experience in manufacturing supervision and administration, with good working knowledge of related responsibilities.

Company located in Michigan, prominent nationally as long established parts supplier. Opening is one of top positions, offering salary commensurate with responsibility.

Please submit complete resumé of personal history, work experience and educational background, with picture if available.

Address CA-4412, % "Mechanical Engineering."

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Research organization seeks services of a man who has a background in experimental stress analysis. Position involves application of stress analysis to relatively untouched field. Ample opportunity for professional growth in stimulating atmosphere. Best of working and living conditions. Permanent position. Midwest location.

Address CA-4389, % "Mechanical Engineering."

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looking for opportunities in

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ENGINEERS

MACHINE DESIGN
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ELECTRICAL POWER DESIGN
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CHEMICAL ENGINEERING DESIGN, RESEARCH, AND DEVELOPMENT

METALLURGISTS

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Qualified graduates with 0–8 years' experience

Send resumé and salary information to

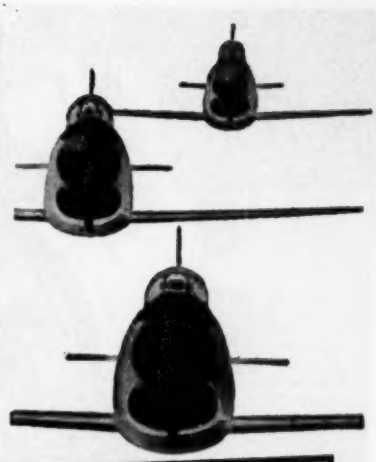
TECHNICAL PERSONNEL OFFICE

CARBIDE AND CARBON CHEMICALS COMPANY

a division of

UNION CARBIDE AND CARBON CORPORATION

POST OFFICE BOX P, OAK RIDGE, TENNESSEE



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PICK A WINNER

The Engineering Department which designed the **Sabre** and other headline-making military airplanes has openings for engineers—experienced in aircraft, recent engineering grads, or men from other fields with adaptable experience. Long-term military projects and twenty-five years of continuous expansion underwrite your future at North American. Current openings in:

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Specialists in all major aircraft fields

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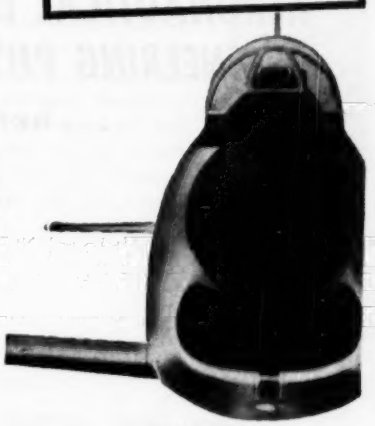

Write to

North American Aviation, Inc.

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LOS ANGELES INTERNATIONAL AIRPORT
LOS ANGELES 45, CALIFORNIA
or
COLUMBUS 16, OHIO

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AERONAUTICAL ENGINEERS
ENGINEERING PHYSICISTS

. . . here's your chance to do *real* engineering !

If you want to explore new technical frontiers — this may be the opportunity you have been looking for.

At Pratt & Whitney Aircraft we are working on the most complex of engineering problems — the development of turboprop, turbojet, ramjet, piston and nuclear aircraft engines.

Because of the advanced nature of the work, you will have opportunities to work beyond present technical boundaries — gain professional recognition. You will learn from the engineers whose designs have gained world-wide acceptance for our products.

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Why not send a complete resume to Mr. Paul Smith, Department ME8.

PRATT & WHITNEY AIRCRAFT
Division of United Aircraft Corporation
East Hartford 8, Connecticut

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To men ready to spread their wings, here's opportunity. We want men with a creative approach to research and development, ability to carry through projects and stimulate coworkers.

Mechanical Engineers—with design experience to act as project engineer on design of complex small mechanical devices.

Location 25 miles from St. Louis gives advantages of both small town and city living.

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AC SPARK PLUG DIVISION OF GENERAL MOTORS CORPORATION

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Positions now available for highest caliber personnel in the field of airborne automatic electro-mechanical control equipment

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New and expanding division of an established firm with 20 years of successful experience in the instrument field. Work involved deals with the manufacture and development of highly complex equipment of the most advanced type.

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AC Spark Plug Division
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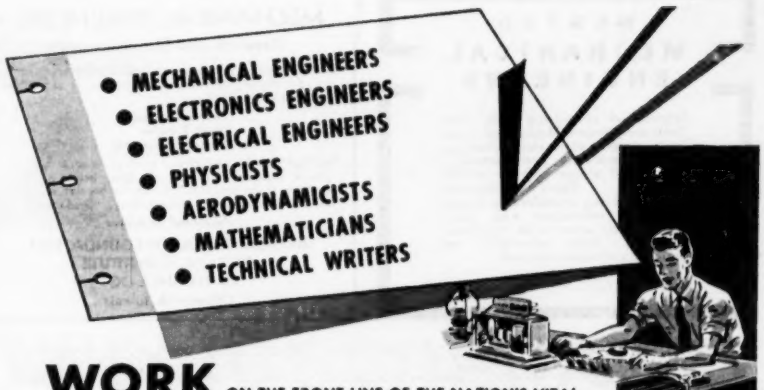
Use a CLASSIFIED ADVERTISEMENT
For QUICK RESULTS



WORK ON THE FRONT LINE OF THE NATION'S VITAL DEFENSE PROGRAM. Sandia Corporation is engaged in the development and production of atomic weapons—a challenging new field that offers exciting opportunities in research and development to men with Bachelor's or advanced degrees, with or without applicable experience. Here you can work with able colleagues, eminent consultants and superior facilities on advanced projects of high importance—and also build a permanent career in a rapidly expanding field with a company that recognizes and rewards individual ability and initiative.

LIVE IN ALBUQUERQUE, THE HEART OF THE SUNNY SOUTHWEST. Located in the historic Rio Grande Valley at the foot of the Sandia Mountains, mile-high Albuquerque is internationally famous for its climate—mild, dry and sunny the year around. A modern, cosmopolitan city of 150,000, Albuquerque offers unique advantages as a place in which to live. Albuquerque's schools, churches, theaters, parks, and modern shopping facilities afford every advantage of metropolitan life—yet hunting, fishing, skiing and a multitude of scenic and historic attractions may all be found within a few hours' drive of the city. New residents have little difficulty in obtaining adequate housing.

ENJOY THESE OTHER IMPORTANT ADVANTAGES. These are permanent positions with Sandia Corporation, a subsidiary of the Western Electric Company, which operates Sandia Laboratory under contract with the Atomic Energy Commission. Working conditions are excellent, and salaries are commensurate with qualifications. Liberal employee benefits include paid vacations, sickness benefits, group life insurance, and a contributory retirement plan. This is not a Civil Service appointment.

Make Application to:

PROFESSIONAL EMPLOYMENT DIVISION

SANDIA *Corporation*

SANDIA BASE • ALBUQUERQUE, NEW MEXICO

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MECHANICAL ENGINEERS

Established consulting firm, New York area, desires Mechanical Engineers, capable supervising starting, testing, operating and correcting troubles of steam electric station equipment. Plant betterment work involving considerable travel. Technical education and plant operating or betterment experience required. State education, experience and salary desired.

Address CA-4417, % "Mechanical Engineering."

MECHANICAL ENGINEERS
Research and Development

Internationally known research organization needs engineers for challenging work on a wide variety of projects in the following fields:

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Bachelor's degree and several years of research or development experience in one of these fields essential. Graduate study desirable. Generous benefits including liberal tuition refunds for college study. Send resumé to:

Personnel Manager

ARMOUR RESEARCH FOUNDATION
OF ILLINOIS INSTITUTE
OF TECHNOLOGY
Chicago 16, Illinois

an important announcement

to all men engaged in

ADVANCED RESEARCH

FROM AMERICAN MACHINE & FOUNDRY

A permanent program of research, rarely found in the field of mechanical engineering, has been launched by American Machine & Foundry, a leader in the design and development of complex automatic machinery for over 51 years.

Our Mechanics Research Department in Chicago is an integral part of the expanding technical operations at AMF, where staff members have the opportunity to see their ideas and the results of their research progress from inception to the finished product.

Here, in an atmosphere of freedom and encouragement, they devote their full time to stimulating, long-range research projects and gain swift recognition for their accomplishments. Salaries, of course, are excellent and there is a liberal plan for advanced study.

If you have confidence in your abilities . . . if you seek broader horizons for your potentialities, you are invited to apply for a position on the staff of the Mechanics Research Department, in:

APPLIED PHYSICS • INSTRUMENTATION
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ENGINEERING

For challenging research problems in

Aerodynamics • Automatic Mechanisms Design • Ballistics • Combustion • Dynamic and Kinematic Analysis • Fluid Flow • Heat Transfer • Operations Research • Propulsion • Rocketry • Servo Systems • Stress Analysis • Thermodynamics • Vibrations

Please forward complete resumé directly to:

Mr. R. A. O'Brien

Mechanics Research Department

American Machine & Foundry Co.

188 West Randolph Street **Chicago 1, Ill.**

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THE LEADING COMPANY
in a
GREAT GROWING INDUSTRY
AIR CONDITIONING
Will Employ

SENIOR DESIGN ENGINEERS

SMALL AIR CONDITIONING EQUIPMENT

- Minimum of 10 years of design experience of which at least 5 years must have been in the development of air conditioning equipment, or domestic and commercial refrigeration units.
- Graduate M.E., E.E. or equivalent.
- Long-range expansion plans offer substantial careers to qualified men.
- Outstanding insurance and retirement program.
- Salary: Open.

Send complete statement of qualifications and starting salary requirements to:

CARRIER CORPORATION
SYRACUSE, NEW YORK
Att: Employment Manager
Supervisory & Technical Personnel

SAFETY AND FIRE PREVENTION ENGINEER

Well established company with multiple plant operations has opening in its industrial relations department. Must be graduate engineer and under age 35. Several years' industrial experience preferred. Responsible for over-all safety and fire prevention program. Traveling required. Home office Chicago.

Address CA-4407, % "Mechanical Engineering."

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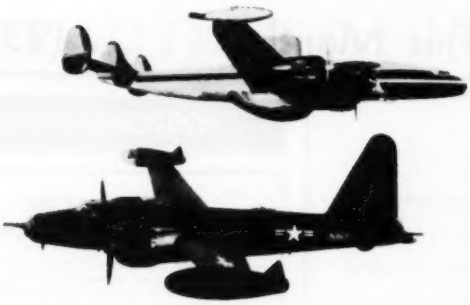
Additional Opportunities are offered in the display advertisements— on pages 114, 116, 122



Three reasons
why Lockheed in California
offers

better careers for engineers

This capacity to develop and produce such a wide range of aircraft is important to career-conscious engineers. It means Lockheed offers you broader scope for your ability. It means there is more opportunity for promotion with so many development and production projects constantly in motion. It means your future is not chained to any particular type of aircraft—because Lockheed is known for leadership in virtually all types of aircraft.

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Huge luxury airliners, cargo transports, fighters, bombers, trainers and radar search planes are rolling off Lockheed assembly lines. Twelve models are in production.

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The most diversified development program in Lockheed's history is under way—and it is still growing. The many types of aircraft now in development indicate Lockheed's production in the future will be as versatile as it is today—and has been in the past.

3 *Diversified Living*

You work better in Lockheed's atmosphere of vigorous, progressive thinking—and you live better in Southern California. You enjoy life to the full in a climate beyond compare, in an area abounding in recreational opportunities for you and your family.

Lockheed AIRCRAFT CORPORATION
Burbank, California

ME 8

"OPPORTUNITIES" Section This Month 123-130

MECHANICAL ENGINEER

General Qualifications

1. Graduate Mechanical Engineer (Registered Engineer preferred).
2. Five (5) years' Engineering Experience (Minimum). Age (35–50 preferred).
3. Experience as Design Engineer and/or Plant Engineer in Chemical Process Industries or Metallurgical plants.
4. Periodic Travel within U.S.A. and Canada for field development work based on observation of actual plant operating conditions.
5. Salary—Open.

Desirable Experience Requirements

1. Mechanical Design of heat and mass transfer equipment in conformance with ASME code for unfired pressure vessels.
2. Screw Conveyor design and operation.
3. Design and operation of Seals for slowly rotating shafts operating in housings subject to high temperatures and liquid or gas pressures and contact with abrasive powdered material.
4. Design and/or selection of and operation of gear drives for screw conveyors.
5. Alloy steel welding design.
6. General supervision of engineering design.

Please send resumé to Chief Engineer,

WESTERN PRECIPITATION CORPORATION

1000 West Ninth Street **Los Angeles 15, California**

INSTRUCTORS WANTED IN MIDWESTERN COLLEGE—1 man to teach and head aeronautical option. One of the best equipped aero laboratories in Midwest. Late model Aerolab Co. wind tunnel. 1 man to take charge of and teach Mechanical Engineering drawing and descriptive geometry. 1 man to teach mechanical drawing and mechanics. Salaries open. Address CA-4377, care of "Mechanical Engineering."

MEDICAL ENGINEERING—Combination advanced degree work in Johns Hopkins Engineering School; instrument design and execution; theoretical and experimental analysis of complex vibrations problem in ballistocardiography project. Write full qualifications, experience, salary level, to Dr. S. A. Talbot, Johns Hopkins Hospital, Baltimore 5, Md.

Positions open for EXPERIENCED INDUSTRIAL ENGINEERING GRADUATES—positions are permanent and offer excellent opportunity for advancement. Please furnish complete resumé of background to Employment Division of The Curtis Publishing Company, Independence Square, Philadelphia 5, Pa.

MECHANICAL ENGINEER—Structural experience required. Will serve as plant engineer of pharmaceutical manufacturer, Northern New Jersey. Maintenance, power plant, grinding experience all helpful. Will consider recent grads. with some experience. Reply full details. Address CA-4423, care of "Mechanical Engineering."

FIELD ENGINEER—Mechanical or Chemical, with refinery experience to provide technical field service on installation and operation of furnaces and combustion equipment in the refining and chemical industries. Knowledge of instrumentation helpful. Must be personable and willing to travel. Please send complete resumé giving age, education, experience, and salary history. Excellent opportunity for advancement. All replies strictly confidential. Petro-Chem Development Company, Incorporated, 122 East 42nd St., New York 17, N. Y.

INVENTIONS

WRITE for information about service for selling inventions. Patent Engineering Development Co., 617 Pioneer American Building, Houston, Texas.

EMPLOYMENT AGENCIES AND SERVICE BUREAUS

PLANT PERSONNEL, ENGINEERS, DESIGNERS—Draftsmen, Chemists, and Metallurgists, E. G. Stroud, Member ASME and President of Cleveland Engineering Agency Co., 2132 E. 9th St., Cleveland 15, Ohio, will help you find positions or men.

ENGINEERS AND EXECUTIVES—This confidential service for outstanding men who desire positions paying $5,000 to $40,000 will develop preliminary negotiations with reputable organizations without risk to present position. For complete details, send experience record and expected salary range. Tomsett Associates, 337 Frick Bldg., Pittsburgh 19, Pa.

SALARIED POSITIONS $3,500 to $35,000. We offer the original personal employment service (established 43 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars.

R. W. BIXBY INC.

115 Dun Bldg. **Buffalo 2, N. Y.**

SALARIED PERSONNEL $3,000—$25,000

This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions, assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited.

JIRA THAYER JENNINGS

Dept. J, 241 Orange Street, New Haven, Conn.

See Advertisements on Preceding Pages

POSITIONS WANTED

DIRECTOR OF INDUSTRIAL ENGINEERING

Consulting management engineer, widely experienced both here and abroad, knows how to analyze the capacity of an organization, evaluate plant facilities and set up effective controls. Competent administrator with background as works manager, vice-president of manufacturing, sales manager.

Seeks responsibility as director of industrial engineering activities for large multiplant manufacturing organization, general manager of a smaller company or staff executive on a top management team.

Engineering graduate, married, excellent health, salary 15,000 plus. Will present complete resumé at personal interview.

Address CA-4427, % "Mechanical Engineering."

Ph.D.—Mechanics, Aerodynamics, with M.S. in Mathematics, 30, non-citizen, desires college teaching position with part time research, or industrial position in theoretical research. Write 116 Ferris Place, Ithaca, N. Y., or phone Ithaca 3-2183.

MECHANICAL ENGINEER—35, Registered PE. Experience in pressure vessels and other process equipment for chemical plants, oil refineries, and brewers. Speaks Spanish. Desires responsible desk or field position. Address CA-4402, care of "Mechanical Engineering."

Available Soon—DEVELOPMENT ENGINEER with extensive experience in research, organization and design of special purpose automatic machinery. Would also consider consultation arrangement on specific problems. Address CA-4404, care of "Mechanical Engineering."

MECHANICAL ENGINEER—35, M.I.T. graduate, P.E., 15 years' experience, instruments and light machinery. For middleweight administrative duties. Versatile, top caliber, excellent record. Address CA-4421, care of "Mechanical Engineering."

MECHANICAL ENGINEER—27, six years' diversified experience in refrigeration, heating and air conditioning; includes instructing, test and development, heat transfer design. Advanced degree in field. Desires position with manufacturer of refrigeration and air conditioning equipment. U. S. or foreign location. Address CA-4422, care of "Mechanical Engineering."

MECHANICAL ENGINEER—25, B.S. Navy Veteran. 2 years' experience in design, maintenance, and incentive work, desires position with progressive Company in Penna. in Plant or maintenance Engineering or management. Send for resumé. Address CA-4424, care of "Mechanical Engineering."

ENGINEERING EXECUTIVE—Chief Engineer of eastern research and manufacturing company with Doctor of Science degree from M.I.T., desires to locate in New England, Middle West or West. Experienced in administration of product development and successful translation of new products into production items. Major fields include mechanics, fluid mechanics, thermodynamics, heat transfer, combustion and application to design. Under 35 years, present salary over $10,000 per year. Address CA-4425, care of "Mechanical Engineering."

MECHANICAL ENGINEER—28, MS, desires responsible position making use of 7 years' experience in plant engineering, research, and process development. Background: food and beverages, textiles and synthetic fibres, and chemical processing. Now employed. Address CA-4428, care of "Mechanical Engineering."

REPRESENTATIVES AVAILABLE

MANUFACTURERS AGENT—Graduate Mechanical Engineer with diversified experience and field contacts in both commerce and industry wants line of equipment or product for primarily western N. Y. coverage from Utica to Erie, Pa. Address CA-4400, care of "Mechanical Engineering."

MANUFACTURERS REPRESENTATIVE—Engineering background. Mechanical, electro mechanical, refrigeration. Metropolitan New York. Address CA-4410, care of "Mechanical Engineering."

***READ THE* CLASSIFIED ADVERTISEMENTS**

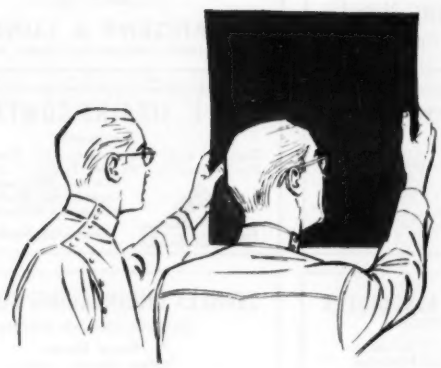
appearing in this section each month.

THE DOCTOR'S DOCTOR

THERE is more to the selection of tube than meets the eye.

You will readily agree that first you must learn "where the tube will be used—and under what conditions" before you are able to select the proper tube.

Some have aptly termed us the "Doctor's Doctor". On modest reflection, we accept the designation and the responsibility of prescribing the correct tube for specific applications much as "The Doctor's Doctor"



Having performed countless "cures" we have naturally earned the reputation throughout industry.

And why not? Today's "cures" result from yesterday's education—encompassing over 36 years' experience in tube manufacture and tube application. Many of the "cases" we have encountered during this long period were of the very kind from which you may now be seeking relief.

Whenever you face the problem of selecting tubes of the right alloys with respect to the materials they must handle under certain conditions, you'll find it most practical to invite our Customer Engineering Service to have one of our specialists counsel with you.

Any of these tubes can be delivered to you immediately from our nearest Mill or Mill Depot, or they can be fabricated to any desired form according to your blueprints.

WOLVERINE TUBE DIVISION
of CALUMET & HECLA, INC.

ESTABLISHED 1916

Manufacturers of Quality-Controlled Tubing
1437 CENTRAL AVENUE • DETROIT 9, MICHIGAN

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Electrical, mechanical, photometric, radiometric and chemical laboratories, rendering testing, research and associated services, including certification, inspections at factories and field investigations.
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Project Engineering, Product Development, Production Designs, Laboratory and Shop Facilities for Research, Model Work, and Pilot Manufacturing
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Consulting Physicists, Mathematicians, and Engineers. Studies in Analytical Engineering and Mathematical Physics
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Methods Studies: Process of Product
Redesign Existing Products for Greater Profit
Trouble Shooting Production, Design, Cost Problems,
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The **Kuljian** *Corporation*
ENGINEERS • CONSTRUCTORS • CONSULTANTS
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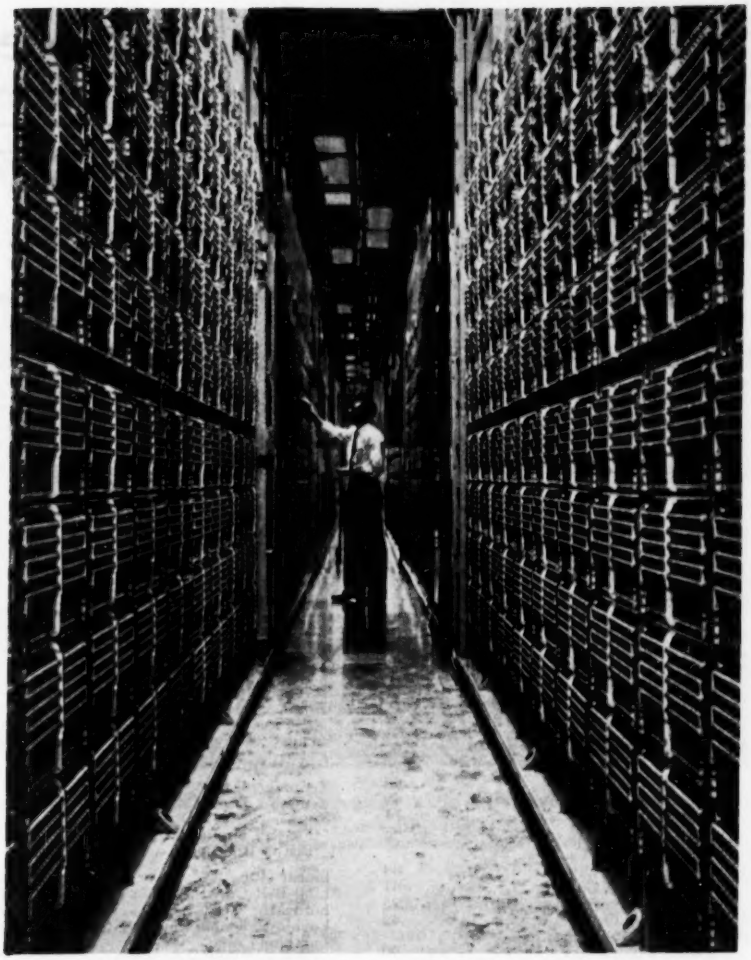
The above consultants are available
to work out solutions
to your engineering and management problems.

Now a new synthetic helps dial telephone service



In a large, modern telephone office, two million relay contacts await the orders of your dial to clear a path for your voice. They open and close a billion times a day.

Unrolled view (one-third size) of capacitor unit wound with "Mylar." The transparent film is only 0.0005" thick yet stands handling without breaking.

AMONG the elements that guard your dial telephone service are electrical capacitors. They help prevent the formation of arcs that pit and may eventually destroy relay contacts. But millions more of these capacitors are needed each year. How could they be made less costly?

Bell Laboratories engineers, on the lookout for new materials, became alert to the possibilities of the new "Mylar" polyester film. A product of the Du Pont Company, "Mylar" is chemically the same as Du Pont's "Dacron" polyester fiber used to make fabrics. Bell engineers discovered that it also had remarkable dielectric properties—of just the right kind to help their capacitor problem.

The film takes the place of impregnated paper formerly used to separate the metal foil electrodes. It is tougher, stands more voltage and needs no impregnation. The new capacitors require no protective housing and are *much* smaller and less costly.

Here is another example of the way America's technology advances through the sharing of knowledge. Just as Bell Telephone Laboratories makes many of its discoveries—the Transistor, for example—available to other companies, so does it adapt the inventiveness of others when it can help your telephone service.

BELL TELEPHONE LABORATORIES

Improving telephone service for America provides careers for creative men in scientific and technical fields

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✶ The asterisk indicates that firm also has product catalog in the 1953 ASME Mechanical Catalog and Directory

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Mast Development Co.
National Weld Testing Bureau
Nuclear Development Assoc.
Palmer, Delos M. & Assoc.
Polachek, Z. H.
Sanderson & Porter
Sargent & Lundy
Sirrine, J. E., Co.
Stanley Engineering Co.
Thompson, John I. & Co.
Tour, Sam & Co.

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*American Brass Co.
*American Felt Co.
American Flexible Coupling Co.
*American Manganese Bronze Co.
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*American Pulverizer Co.
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*Associated Spring Corp.

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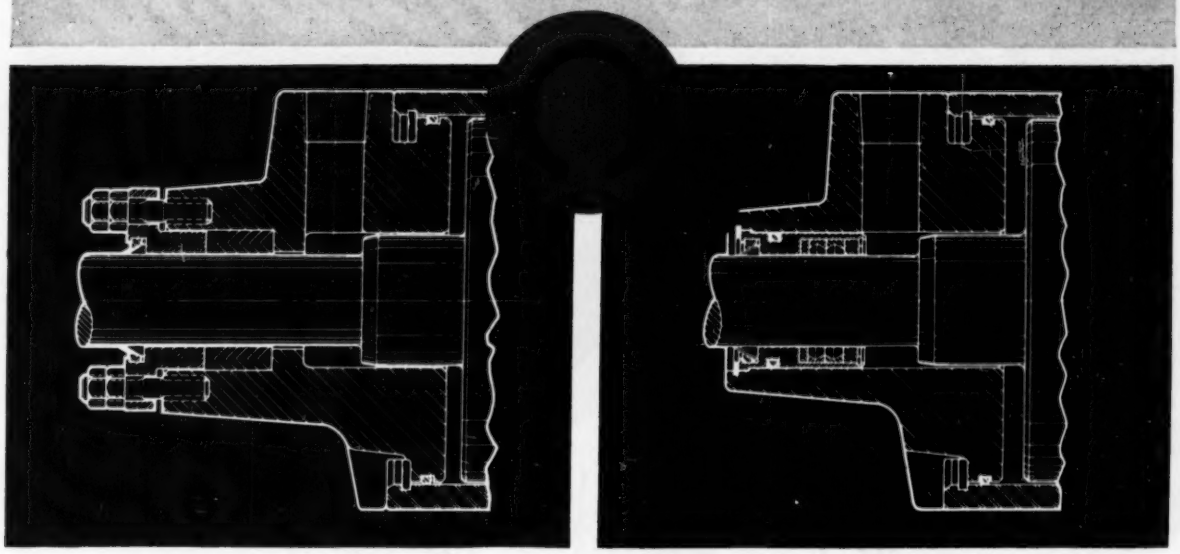
Waldes Truarc Ring Saves $2.84 Per Unit, Cuts Labor-Time and Materials in Hydraulic Packing Unit



OLD STYLE stuffing box required skilled worker to install packing rings one at a time, then adjust packing glands by trial and error. Disassembly was equally difficult, time-consuming and costly.

NEW Monopak Cartridge is smaller, lighter, streamlined and installed with one Truarc Retaining Ring. Disassembly and reassembly with new cartridge takes unskilled worker just 1 minute.

Hydraulic Accessories Company of Van Dyke, Michigan, uses a single Waldes Truarc Inverted Ring (internal series 5008) to hold Monopak Cartridge in cylinder head.

New design eliminates costly machining and saves 2⅛ lbs. of material. Re-design with Waldes Truarc Retaining Ring reduces stuffing box diameter from 3½" to 2⅞", and reduces length from 5⅞" to 4⅜". Allows savings in assembly, adjusting and testing.

NEW DESIGN USING WALDES TRUARC RING PERMITTED THESE SAVINGS PER UNIT

MACHINE TIME SAVED:	
Chucking, facing and boring	$ .72
Drilling and tapping 3 holes	.18
Drilling and counterboring 3 holes	.12
Assembling, adjusting, testing	.90
MATERIAL SAVED:	
1⅛ lbs. cast iron	.30
⅛ lb. bronze	.23
3 studs	.36
3 nuts	.03
TOTAL	**$2.84**

Waldes Truarc Retaining Rings are precision-engineered . . . quick and easy to assemble and disassemble. Always circular to give a never-failing grip. They can be used over and over again. There's a Waldes Truarc Ring to answer every fastening problem.

Find out what Waldes Truarc Retaining Rings can do for you. Send your blueprints to Waldes Truarc engineers for individual attention, without obligation.

For precision internal grooving and undercutting . . . Waldes Truarc Grooving Tool.

SEND FOR NEW CATALOG

WALDES

TRUARC

REG. U. S. PAT. OFF.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS: 2,382,947; 2,382,948; 2,410,052; 2,420,921; 2,428,341; 2,439,785; 2,441,848; 2,459,185; 2,483,380; 2,483,383; 2,487,002; 2,487,003; 2,491,306; 2,509,091 AND OTHER PATENTS PENDING

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.

Please send me the new Waldes Truarc Retaining Ring catalog.

(Please print) ME 085

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Title.....

Company.....

Business Address.....

City..... Zone..... State.....

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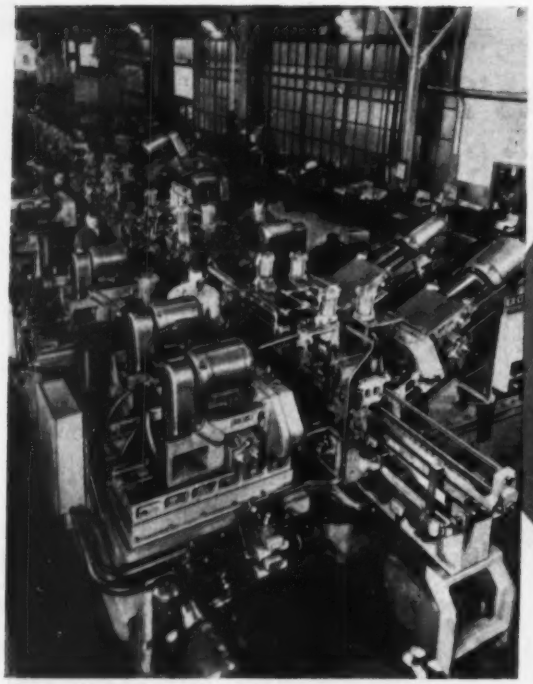


Photo Courtesy Ex-Cell-O Corp., Detroit, Mich.

Trabon

AUTOMATIC LUBRICATION
used on transfer machines
in large automotive plant

this has a BEARING on the subject

Illustrated here are transfer machines typical of several installed in the manufacturing plant of a large automotive producer . . . the first of which was put in operation during the early part of 1951.

Each of these machines is being automatically lubricated with a TRABON system. Two systems cover 195 bearing points each; two, 151 points each; and two, 305 points each.

Each system is so proportioned that slides, ways and heavily loaded working bearings receive the proper amount of lubricant every 20 to 30 minutes. All minor bearings on fixtures receive the exact amount of lubricant required every four hours.

Whether your problem is to lubricate a hot metal crane, crushers, ore unloaders, presses, rolling mills, blast furnaces, boring mills, or any other industrial application . . . a TRABON system is your answer.

Completely sealed—positive—hydraulic—handles oil or grease—backed by years of experience.

WRITE FOR BULLETIN 529

Trabon

ENGINEERING CORPORATION

1814 E. 40th STREET • CLEVELAND 3, OHIO

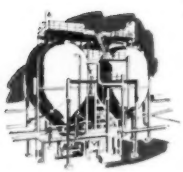
Oil and Grease Systems

Part of Shell Oil Company's modern Houston, Texas refinery which processes 125,000 barrels of crude oil daily.

PERMUTIT ION EXCHANGERS

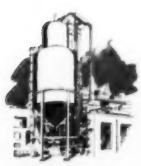
deliver highest purity makeup for SHELL

BOILERS in this enormous Shell refinery operate at 650 psi. Steam output is received by turbo-generators . . . exhausted to process. ¶ To insure continuous steam turbine operation—for greater efficiency and more economical production—Permutit Demineralizing Equipment treats makeup water. The ion exchange units at right have a continuous capacity of 96,000 gph. ¶ The raw well water supply contains high total dissolved mineral solids—324 ppm, a harmful amount of silica—13 ppm. Its total hardness is 70 ppm, methyl orange alkalinity 230 ppm. ¶ This installation—a Permutit Two-Step Demineralizer with Degasifier—removes virtually all dissolved mineral solids. Silica is reduced to under 0.2 ppm. The effluent is purer than most distilled waters, costs much less to produce. Most important, costly shut-downs from heavy scale on turbine blades are prevented. ¶ Permutit makes all types of ion exchangers and water conditioning equipment . . . can save you time and money in the specification of the one combination that best suits your needs. ¶ For aid in solving your own water problems, write to The Permutit Company, Dept. ME8, 330 West 42nd St., New York 36, N. Y. or Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

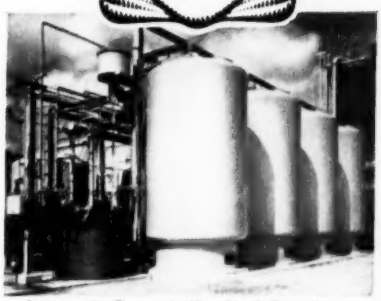


Sludge Blanket Hot Lime Soda

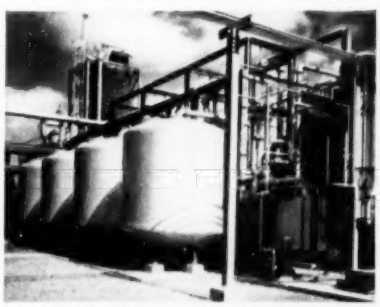
Hot Zeolite-Permutit Q



Deaerating Heater



Automatic Permutit Zeo-Karb® units remove metallic cations from Shell's well water supply. Effluent passes to Degasifier at right for low cost CO_2 reduction.



Automatic Permutit S units remove remaining troublesome mineral impurities by anion exchange.

PERMUTIT®

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS FOR OVER 40 YEARS

Makes delicate cuts on short, thin-wall, large diameter parts automatically

with help of TIMKEN® bearings

SPEED, precision and automatic operation—these are the machining qualities built into Lodge & Shipley's new 30″ T-Matic. With the bed at right angles to the spindle, it face contours, bores, turns big parts with small-lathe accuracy.

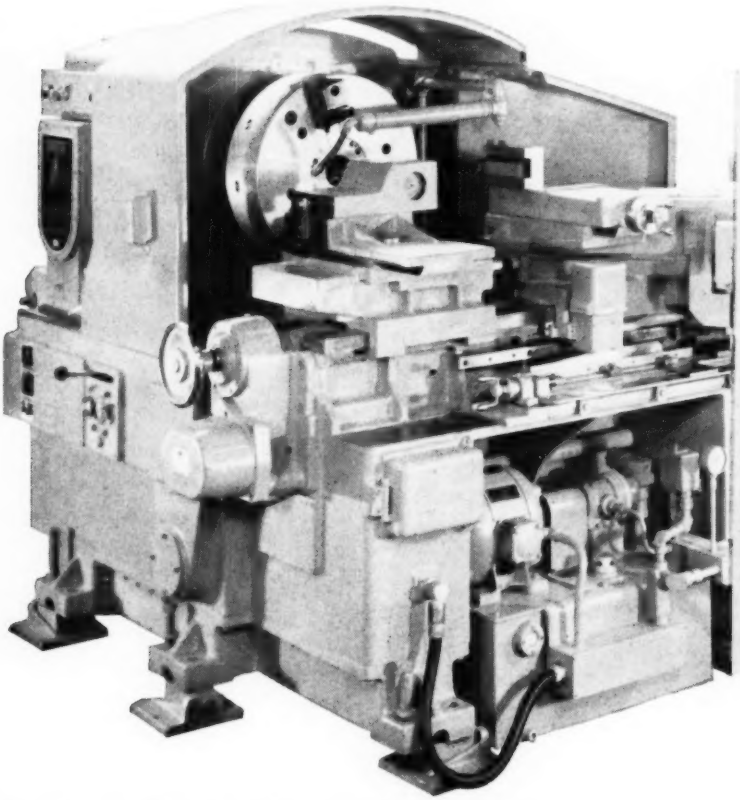
Since all the T-Lathe's work is single chucked, the spindle must be completely free of end play. Otherwise face contouring accuracy would be affected. Any wobble or chatter in the spindle would be doubled or tripled near the outside of large diameter parts.

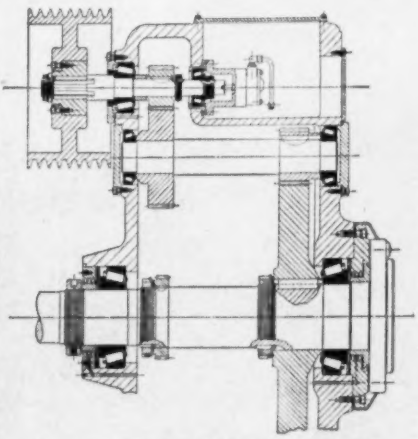
For these reasons, Lodge & Shipley mounted the spindle on 2 Timken® bearings. Their tapered rollers are preloaded during assembly, eliminating both end and side play. Since the spindle must support large work pieces, these are large diameter bearings. Yet their run-out never exceeds three ten-thousandths of an inch (.0003″).

Made of the Timken Company's own fine alloy steel, Timken bearings normally last the life of the machine tool they're a part of. Building or buying machines, specify "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

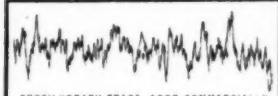
TIMKEN BEARING EQUIPPED

This symbol on a product means its bearings are the best.

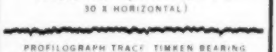




How **THE LODGE & SHIPLEY COMPANY** mounts T-Lathe spindle on Timken bearings to get accuracy needed for delicate work on large diameter pieces.



PROFILOGRAPH TRACE, GOOD COMMERCIALLY GROUND FINISH (5,000 X VERTICAL, 30 X HORIZONTAL)



PROFILOGRAPH TRACE, TIMKEN BEARING FINISH (5,000 X VERTICAL, 30 X HORIZONTAL)

OPTICAL FLAT, PERFECT FINISH

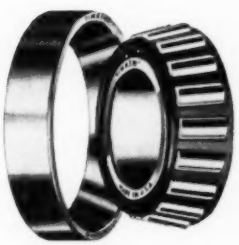
SMOOTH TO MILLIONTHS OF AN INCH

Surface finish of high quality Timken bearing rollers and races is so smooth that it takes a profilograph to measure its smoothness. This instrument measures surface variations to a millionth of an inch, as shown at the left.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ↓ AND THRUST →○← LOADS OR ANY COMBINATION →○←